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PHYSICAL TASKS OF MILITARY OCCUPATIONAL SPECIALTIES AS RISK FACTORS FOR KNEE-RELATED DISABILITY DISCHARGE

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13. ABSTRACT *(Maximum 200 words)*

This report explores the relationship between physical demands of military occupations and disabling knee injury among men and women in the U.S. Army. The primary goal is to group military occupational specialties (MOSs) into a classification system that describes the physical demands of the job, and then to determine whether that classification system is useful in predicting the risk of knee-related disability discharge associated with a particular MOS. The study population was 7,454 cases and controls selected from the Total Army Injury and Health Outcomes Database (TAIHOD). Primary MOSs were grouped into 11 categories: Physical Demand Rating, Maximum Weight Lifted, Maximum DistanceRun/Walked, Maximum Time Walked, Lift and Carry, Kneeling, Climbing, Pushing/Pulling, Sitting, Standing, and Career Management Field. All analyses were stratified by gender, race, and age. Logistic regression models were constructed separately for males and females. The physical activities that had the strongest associations with disabling knee injury were maximum weight lifted, pushing/pulling, kneeling, sitting, and standing. Gender, race, and age differences are noted. Disabling knee injuries are associated with occupational risk factors, and a system of classifying occupations into groups by physical activities can identify risk factors that may cause knee-related disability discharge.

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EXECUTIVE SUMMARY

Injury mortality is a serious problem in America, as demonstrated by the fact that injury is the leading cause of death among Americans under the age of 44. Injury mortality is only part of the problem, however, as injury morbidity also has serious economic and humanitarian consequences. Disabling injuries, in particular, are associated with considerable direct and indirect costs. The U.S. Army estimated disability payments in 1994 of $500 million; this figure did not include cost of medical treatment, or salary and benefit costs for soldiers who are on "no duty" or "limited duty" status. In addition to these direct and indirect costs, there are human costs of pain and suffering. Reducing these costs and mitigating the human suffering associated with disabling injuries will require a better understanding of the risk factors for such injuries, so that effective preventive measures can be put in place.

We know from a review of the literature that many disabling injuries are associated with occupational risk factors. The purpose of this report is to examine one type of disabling injury, knee injury, among men and women in the U.S. Army. The primary goal is to group military occupational specialties (MOSs) into a classification system that describes the physical demands of the job, and then to determine whether that classification system is useful in predicting the risk of knee-related disability discharge associated with a particular MOS.

Using a case-control study design, the specific research question was, do cases have different physical tasks or demands than controls, based on their MOS description? This project was conducted using the Total Army Injury and Health Outcomes Database (TAIHOD), a relational database maintained at the U.S. Army Research Institute of Environmental Medicine (USARIEM). A subset of 7,454 individuals was selected from the TAIHOD, representing 1,005 cases and 3,009 controls among males and 860 cases and 2580 cases among the females. Frequency distributions identified the 50 most common MOSs among men and women. Individuals with these MOSs were selected for inclusion in the study population. For this study, researchers used the primary MOS (PMOS) rather than the duty MOS (DMOS), because a considerable and varying percentage of cases and controls were missing DMOS information. (The PMOS was found, however, to correlate closely to the DMOS among those cases and controls who had information on both.)

PMOSs were grouped into 11 categories: Physical Demand Rating, Maximum Weight Lifted, Maximum Distance Run/Walked, Maximum Time Walked, Lift and Carry, Kneeling, Climbing, Pushing/Pulling, Sitting, Standing, and Career Management Field. All analyses were stratified by gender, race, and age. Logistic regression models were constructed separately for males and females, although the same variables were included in both for purposes of consistency.

We conclude that this study supports the hypothesis that disabling knee injuries are associated with occupational risk factors, and that the system of classifying

occupations into groups by physical activities serves to identify those risk factors that may cause knee-related disability discharge.

The physical activities that had the most striking associations were maximum weight lifted, pushing/pulling, kneeling, sitting, and standing. As maximum weight lifted increased, the odds of having a knee-related disability discharge increased. The pushing/pulling category also had an increasing trend, but only for women. No trend was established for men. For both genders, sitting and standing reduced the odds of a knee-related disability discharge, whereas kneeling increased the odds of this type of discharge. The results of this study are in accordance with other studies that show an elevated risk of knee injury in female athletes when compared to male athletes. Both genders showed racial differences; in particular, non-white women were less than half as likely to have a knee-related disability discharge as compared to white women, whereas non-white men were 80% as likely to have a knee-related disability discharge as compared to white men. This study found no association between the risk of knee-related disability discharge and the amount of running or walking, although it is important to note that other studies which have found such an association did not control for as many other physical activity variables as this one.

There are many possible explanations for these results. For example, the differences in rates of knee-related disability discharge may be due to physiological differences across race and gender, or the system of assigning individuals to disability status in the U.S. Army may be subject to racial or gender bias. Other possible explanations might be found by assessing the physical fitness of men and women assigned to various jobs. For example, it is possible that a soldier who performs a job that requires a lot of sitting may not be physically fit enough to safely perform the occasional lifting that the job requires. There may also be differences in the way men and women perform physical activities within the same MOS. For example, men may do more kneeling than women, even if they hold the same MOS. Further research is needed to explore these questions.

Although this study has some limitations, and is limited in its generalizability, the implications with respect to injury prevention are significant. When studies such as this one identify risk factors that are associated with a particular type of injury, the results can be used to focus prevention programs and interventions. If such interventions reduce the incidence of disabling knee injuries, there can be significant reductions in the economic and humanitarian burdens associated with disability.

INTRODUCTION

It is important to perform research on injuries for both fiscal and humanitarian reasons. Injuries are the fourth leading cause of death in Americans of all ages[1] and the leading cause of death in persons under the age of 44.[2] In addition to the serious mortality problems posed by injury, many individuals live permanently with the outcome of a disabling injury. Such injuries can be expensive to treat and have indirect costs in addition to the direct costs associated with the initial hospitalization. For example, the U.S. Army estimated in 1994 that the fiscal impact of physical disability in the Army was 500 million dollars for disability payments alone, and this figure did not include medical treatment or salary and benefit costs while the soldier was on "no duty" or "limited duty" status.[3]

Besides the economic impact of injuries, human lives are affected in various other ways. Injured individuals experience suffering, and if severe enough, family and friends may suffer as well. Even if the physical pain is minor, an injury can inhibit lifestyle, and if movement is impaired, it may be difficult to perform daily tasks. Also, injured individuals or family members may experience emotional pain through loss of a limb, lost time on the job, lost wages, or loss of a job. With further research, the risk factors for injury can be determined, which in turn can lead to a reduction of injuries and their consequences through prevention.

We know from a review of the literature that many injuries are occupationally related.[4,5] One of the obstacles in research of causes of injury, however, is the lack of comprehensive databases for research. One database that could be used for these studies is the Total Army Injury and Health Outcomes Database (TAIHOD), created and maintained by the U.S. Army Research Institute of Environmental Medicine (USARIEM) in Natick, Massachusetts.[6] USARIEM is part of the U.S. Army Medical Research and Materiel Command (USAMRMC). Its research mission is to study medical problems among the armed forces that are of importance to national defense.[6]

In particular, the Army recognizes the need to perform research on women, since little research has been done, and women currently comprise 14% of the active-duty military. To support this research, Congress appropriated $40 million dollars for the Defense Women's Health Research Program (DWHRP). The DWHRP subsequently funded USARIEM's research proposal entitled "The Impact of Injuries on the Health and Readiness of Women in the Army from 1980–1994." This project was designed to investigate injuries among women in the Army using a relational database combined from a variety of Army and Department of Defense sources. This database is called the Total Army Injury and Health Outcomes Database (TAIHOD).[6] Since this database was initially funded through the DWHRP, many of the research questions that have been explored using the TAIHOD have focused on women, although it includes information on men in the Army as well.

The TAIHOD initially linked six databases (see Table 1) and currently has information on approximately 2.5 million current and former active-duty personnel,[6] of whom about 11.8% are women,[7] so the power for analytic epidemiology studies of many specific injuries is adequate. Since the occupational data are linked to health and injury data, the TAIHOD is a uniquely rich resource for studying the occupational risks of injury.

Table 1. Total Army Injury and Health Outcomes Database (TAIHOD) Overview

Defense Manpower Data Center (DMDC)	**Personnel data:** demographic variables, pay files, loss files (arrival and departure information), Gulf War activation files.
Individual Patient Data System (IPDS)	**Hospitalization data**: demographic variables, diagnosis, injury type/cause, bed days, non-army hospitalization.
Army Safety Management Information System (ASMIS)	**Lost-time injury data:** demographic variables, unintentional aviation incidents, unintentional ground incidents, event-specific information.
Army Disability Data	**Disabilities:** demographic variables, diagnosis, percentage disability, functional disability codes, work-relatedness, case outcomes.
Army Casualty Information Processing System (ACIPS)	**Fatality data:** demographic variables, event specific information, and cause of death.
Health Risk Appraisal (HRA)	**Health habits data:** demographic variables, self-reported health habits, psychological and physiological measurements.

The primary objective of this report is to create a system for categorizing occupations within the Army by physical tasks. This permits meaningful analysis of the relationship between occupation and, for example, knee-related disability discharge. The primary goal was to develop groupings of military occupational specialties (MOS) according to their defining characteristics. Each military occupation has an MOS associated with it, which includes information on job title, gender requirements, and physical tasks (see Tables 2 and 3). There are more than 300 MOSs in the Army, some of which have physical tasks that may be associated with risk of injury. These MOSs are available in the TAIHOD for each soldier over the time he or she worked in the Army. The physical task groupings that were developed in this project were physical demand rating, maximum weight lifted, maximum distance run/walked, time walked, weight lifted and carried, height climbed, hours spent sitting, hours spent standing, amount of kneeling, weight pushed/pulled, and career management field. The secondary goal of this study was to determine if the resulting classification scheme was useful in predicting the risk of knee-related disability discharge. Using a case-control design, the specific research question was, do cases have different physical tasks or demands than controls, based on the MOS description?

Table 2. Sample Military Occupational Specialty Open to Both Genders

MOS: 94B
Title: Food Service Specialist
Gender: Open
Physical Demand Rating: Heavy
Physical Tasks:

1. Occasionally lifts 100 pounds 2 feet and carries 100 feet as part of a 2-soldier team (prorated 50 pounds).
2. Frequently pushes, pulls, lifts, and carries 50 pounds.
3. Occasionally digs, lifts, and shovels 21-pound scoops of dirt 3 x 3 feet while bending, stooping, or kneeling.
4. Frequently stands and/or walks for a period of 4 hours duration.
5. Must possess normal color vision.
6. Must possess finger dexterity in both hands.
7. Frequently writes to keep records and compile data.

Table 3. Sample Military Occupational Specialty That is Closed to Women

MOS: 11B
Title: Infantryman
Gender: Closed to Women
Physical Demand Rating: Very Heavy
Physical Tasks:

1. Frequently visually identifies vehicles, equipment, and individuals at long distances.
2. Occasionally raises and carries 160-pound person on back.
3. Frequently performs all other tasks while carrying a minimum of 65 pounds, evenly distributed over entire body.
4. Frequently digs, lifts, and shovels 21 pounds scoops of dirt in bent, stooped or kneeling position.
5. Must be able to hear oral commands in outdoor area from distances up to 50 meters.
6. Frequently walks, runs, crawls, and climbs over varying terrain for a distance of up to 25 miles.
7. Frequently runs for short distances.
8. Occasionally walks slowly for 2 hours out of 6 while carrying 26 pounds.
9. Frequently lifts and lowers 32 pound bags shoulder high.
10. Frequently gives oral commands in outside area at distances of up to 50 meters.
11. Frequently throws 1 pound object 40 meters.
12. Occasionally throws 1 pound object 40 meters.
13. Occasionally climbs a rope distances of up to 30 feet.
14. Occasionally performs all other tasks while carrying a minimum of 65 pounds evenly distributed over entire body.

REVIEW OF THE LITERATURE

OCCUPATIONAL KNEE INJURIES

Occupational factors are known to be associated with increased knee injuries.[3,4] For example, there is a higher prevalence of knee disorders in people who kneel or squat at work[4] or whose jobs have very heavy physical demands.[3] Physical tasks of kneeling appear in some MOS descriptions (Tables 2 and 3). One such task of an infantryman is stated as "frequently digs, lifts, and shovels 21-pound scoops of dirt in bent, stooped, or kneeling position" (Table 3).

Knee injuries are also associated with certain sports, such as professional or recreational volleyball, soccer, basketball, and rugby.[5,8] One study showed injuries in volleyball players to be associated with physical movements such as planting and cutting, straight-knee landing, and one-step stop landing with knee hyperextended.[5] Another study showed sports with contact, such as rugby, to have higher levels of knee injuries than non-contact sports.[8] Physical task descriptions such as running are also included in the MOS (Tables 2 and 3). For example, "frequently walks, runs, crawls, and climbs over varying terrain for a distance of up to 25 miles" is a task of an infantryman (Table 3).

GENDER

Many studies have shown differences in frequency and types of knee injuries between men and women. For example, it has been reported that women athletes injure their knees more than men athletes, especially the anterior cruciate ligament (ACL).[5,9–11] This may be due to anatomical differences between the genders. Women, on the average, are shorter, have wider hips and narrower shoulders, have shorter legs and arms, and are weaker in lower and upper body strength than men.[12–15] Furthermore, women have a different shaped femur notch through which the ACL runs, a slope in the knees from wider hips, and tend to have looser joints.[10]

MILITARY STUDIES

One of the earliest articles on the risk of injury to soldiers was published in 1983. It was a descriptive review of injuries in the lower extremities associated with running, jogging, and marching.[16] Prior physical condition, physical anomalies, body weight, previous injury, gender, training surface, footwear, and training techniques were found to influence the incidence of injuries. The author stated that too much running, marching, or weight lifting without proper recovery could lead to injury.

In 1987, a case-control study was published on the risk of injury in soldiers.[17] Cases were soldiers with new injuries who were presenting for medical care for the first

time. Controls were a random sample of uninjured soldiers at the same medical facilities. A potential selection bias in this study may have influenced results, since any soldier who did not come to the medical center would not be included in the study. The results indicated that risk factors for injury included age, gender, unit of assignment, location of housing, and amount of weekly exercise. Also, combat units had higher injury rates than non-combat units. Rates of injury also increased with the amount of exercise. These findings suggest that injuries are related to physical tasks, including those tasks that are required to perform specific military jobs.

Since the 1980s several authors have studied risks of injury associated with basic military training in the Army.[18–20] Jones et al. followed a cohort of Army infantrymen over 12 weeks of training.[18] They were given baseline and follow-up evaluations. A questionnaire collected data on demographic variables and job activity levels. Measurements of physical fitness were taken to gather data on body mass index, height, weight, neck and wrist girths, flexibility, a 2-mile run time and number of sit-ups and push-ups in a timed interval. Injury cases were defined as any individual requiring treatment for one or more lower extremity musculoskeletal injuries, such as strains, sprains, stress fractures, and tendinitis. A statistically significant increased risk was associated with musculoskeletal injury and increased age, smoking, and top fifth and bottom fifth percentile of flexibility. There was a non-statistically significant association between musculoskeletal injury and distance run. No association was found between these injuries and previous job activity.

Jones et al. may not have found an association between musculoskeletal injury and job activity levels due to the source of information. Job activity level was self-reported as moderate to heavy, light, or very light. This information is based on the perceptions of the individual as they relate to physical fitness. The same job activity level may be rated as more difficult by a less physically fit person than a more physically fit person, possibly introducing misclassification bias.

When Jones et al. compared injuries in two training units that differed in the amount of running, they found a non-statistically significant association between musculoskeletal injuries and running.[18] The unit that ran more miles had an odds ratio for musculoskeletal injury of 1.6 (95% CI = 0.9–2.7) compared to the other unit. Although not statistically significant, this finding suggests that the amount of running could be a risk factor for musculoskeletal injuries.

In 1994, another study followed a cohort of soldiers through infantry training.[19] A questionnaire collected data on potential risk factors such as smoking history and past running injuries. As in the previous study,[18] researchers gathered data on body weight, height, body mass index, flexibility, and strength. Baseline physical fitness was assessed via the Army Physical Fitness Test (APFT), which measures the number of sit-ups performed in 2 minutes, number of push-ups completed in 2 minutes, and the total time to complete a 2-mile run. Injuries were defined as any traumatic or overuse injury occurring during the training period that resulted in a clinic visit. A training injury

was defined as any musculoskeletal complaint that resulted in a clinic visit and that was supposedly caused by physical training. Specifically, overuse injuries were musculoskeletal injuries (such as tendinitis, patellofemoral syndrome, and stress fractures) caused by repetitive motion and associated with activities such as running and marching.

Reynolds et al. found that 55% of soldiers experienced one or more injuries.[19] Eighty-eight percent of these injuries were attributed to physical training or vigorous operational activities. The five most common injuries were sprain, musculoskeletal pain, strain, tendinitis, and other overuse injuries. Ninety-two percent of the training-related overuse injury clinic visits involved the lower extremities and lower back. Feet were the part of the body most commonly affected (20.8%), followed by the knee (17.6%). The soldiers who had 2-mile run times in the slowest quartile had the highest incidence of low-back and lower extremity injuries. There was a dose-response relationship between number of cigarettes smoked per day and these injuries.

In another study of injuries sustained in basic military training, researchers used a case-control study design.[20] Cases were defined as recruits having had a musculoskeletal injury during the basic training course that was severe enough to delay their progress in completing the course. Control subjects were randomly selected from recruits who completed the training course in the same time period without sustaining an injury. Statistically significant associations with odds of injury were found between female gender, body mass index greater than 26.9%, winter training, a history of lower limb injury, and presence of lower limb deformity. No association was found for height, weight, age, smoking, or the male-to-female ratio of individuals in the course.

The results of these studies emphasize the need for studying the role of gender on risk of injury. In addition, case-control studies should study the role of potential confounders, such as the season in which the soldier became disabled and the presence of previous injury.

A retrospective cohort study looked at infantry soldiers assigned to a battalion in Alaska[21]. Subjects were male soldiers assigned to this battalion. Physical fitness was determined by the Army Physical Fitness Test (APFT). Injury data were collected from a review of the soldiers' medical treatment records for the 6 months prior to the APFT. An injury was defined as any acute, overuse, or traumatic event noted in the medical record during the 6-month period. The first visit for a specific injury was used as a marker for a new injury. Injuries were divided into two categories: musculoskeletal and all other injuries. Knee injuries accounted for 10.4% of musculoskeletal injuries and 1.4% of all other injuries.

Significant differences were found between physical fitness, as determined by the APFT and musculoskeletal injuries. Soldiers in the quartile for the slowest 2-mile run were 1.6 times more likely to have been injured than soldiers in the fastest quartile for the 2-mile run. Soldiers in the quartile performing the lowest number of sit-up

repetitions in 2 minutes were 1.9 times more likely to have been injured than soldiers in the quartile performing the most repetitions. There was not a significant relationship between push-up repetitions and musculoskeletal injury.

Other military studies have used physical descriptions of MOSs as risk factors for injury [3] or pregnancy-induced hypertension. [22] For example, one study found that MOSs in the Army most associated with musculoskeletal disability were characterized as having moderately heavy, heavy, and very heavy physical job demands based on MOS description.[3]

A retrospective cohort study of pregnancy-induced hypertension and occupation considered Navy personnel.[22] The investigators grouped occupations based on exposure definitions. These are more specific categories than the ones described in the previous example,[3] which simply had broad physical demand groups. This study used the Retrospective Case-Mix Analysis System (RCMAS) for the outcome based on hospital discharge data.[22] This is a component of the Defense Medical Information System. The demographic data were obtained by matching Social Security numbers to the database maintained by the Defense Manpower Data Center. The job classification was determined by a code in the Defense Manpower Data Center. An increased risk of transient gestational hypertension was found for jobs requiring high levels of standing, medium levels of physical exertion, and lifting. Although the Navy did not study injury in this trial, it is an example of grouping occupational physical tasks as risk factors for a specified outcome.

In summary, the literature supports associations between occupational physical tasks and injuries. In particular, kneeling, squatting, running, marching, and physical demand rating were indicators of injury in previous epidemiologic studies. Furthermore, several studies showed that knee injuries are among the most common musculoskeletal injuries. This information helped form the objective of the current report, which was to analyze by means of a case-control study whether it would be possible to create military occupational specialty groups based on physical tasks and to assess any association with disabling knee injuries.

METHODS

TAIHOD CASE-CONTROL STUDY

Sulsky et al. are currently using the TAIHOD in a case-control study to assess occupational risk factors for knee injuries in the U.S. Army.[7] The cases are all soldiers disabled between 1980–1994 defined by 11 Veterans Administration System for Rating Disabilities (VASRD) codes (Table 4). These VASRD codes were directly related to a knee disability that resulted in discharge and were chosen with the help of a military physician.[23] There were 860 women and 7,868 men who met this definition.

Table 4. VASRD Codes Used to Define Cases in the Pilot Study of the U.S. Army, 1980–1994

VASRD Code	Description
5055	knee replacement
5160	thigh amputation: disarticulation with loss of extrinsic pelvic girdle muscles
5161	thigh amputation: upper third, one third of the distance from the perineum to knee joint
5163	leg amputation with defective stump, thigh, amputation recommended
5255	impairment of femur
5256	ankylosis of the knee
5257	other impairment of the knee
5258	semilunar dislocated cartilage with frequent episodes of 'locking' and pain
5259	semilunar removal of cartilage
5262	impairment of the tibia and fibula
5263	genu recurvatum (acquired, traumatic, with weakness and insecurity in weight-bearing objectively demonstrated)

Controls were chosen by a density sampling approach, stratified by gender and year of disability of cases. The controls were individuals without a knee disability matched to year of the case injury. Six female controls were chosen for each female case and 1.5 male controls were chosen for each male case. This established the data library, from which all of the female cases and a random sample of 1005 male cases (67 cases per year) were chosen. Also from the data library, three controls per case were chosen, stratified by gender. This double extraction method was used to obtain a relatively small but reasonably representative sample for a pilot study (Figure 1). This yielded 7,454 individuals, representing 1,005 cases and 3,009 controls among males and 860 cases and 2,580 controls among females. These comprise the sample for this report.

Figure 1. Composition of Data for Study of Physical Tasks of Military Occupational Specialties as Risk Factors for Disabling Knee Injuries in U.S. Army, 1980–1994

TAIHOD
(1980–present)

Approximately 2.5 million individuals

DATA LIBRARY
(1980–1994)
(Cases are from the Disability File and
Controls are from the Personnel File)

Total: 25690 individuals
Men: 19670 individuals = 7868 cases + 1.5 controls/case
Women: 6020 individuals = 860 cases + 6 controls/case

PILOT STUDY
(1980–1994)

Total: 7454 individuals
Men: 4014 individuals = 1005 cases (67 cases/year) + 3 controls/case
Women: 3440 individuals = 860 cases (all cases) + 3 controls/case

TOP 50 PMOSs STRATIFIED BY GENDER:
DATA USED FOR GROUPING BY PHYSICAL TASKS
(1980–1994)

Total: 5400 individuals
Men: 2768 individuals = 730 cases + 2038 controls
Women: 2632 individuals = 626 cases + 2006 controls

MOS VARIABLES

The physical task descriptions used to make the physical task groupings came from the Military Occupational Specialties descriptions.[24] The U.S. Army has two types of MOSs for each individual, the primary MOS and the duty MOS. The primary MOS (PMOS) is the occupation for which the soldier is trained. The duty MOS (DMOS) is the occupation that the soldier performs. The TAIHOD has information on both DMOS and PMOS for each soldier at 6-month intervals. A preliminary analysis was performed on DMOS and PMOS to determine which one would be used in this study (Tables 5 and 6).

Table 5. Descriptive Statistics for Individuals in the Pilot Study with a Missing Duty Military Occupational Specialty (DMOS) in Year of Disability (DISYR)

	CASES		CONTROLS	
	N	Percent	N	Percent
TOTAL	464		748	
PMOS in DISYR = past DMOS	53	11.42	104	13.90
PMOS in DISYR ≠ past DMOS	8	1.72	24	3.21
PMOS in DISYR = DMOS in following year	5	1.08	352	47.06
No DMOS in following year or PMOS ≠ DMOS in following year	398	85.78	268	35.83
MEN	184		308	
PMOS in DISYR = past DMOS	30	16.30	64	20.78
PMOS in DISYR ≠ past DMOS	5	2.72	7	2.27
PMOS in DISYR = DMOS in following year	1	0.54	156	50.65
No DMOS in following year or PMOS ≠ DMOS in following year	148	80.43	81	26.30
WOMEN	280		440	
PMOS in DISYR = past DMOS	23	8.21	40	9.09
PMOS in DISYR ≠ past DMOS	3	1.07	17	3.86
PMOS in DISYR = DMOS in following year	4	1.43	196	44.55
No DMOS in following year or PMOS ≠ DMOS in following year	250	89.29	187	42.50

Table 6. Descriptive Statistics for Individuals in the Pilot Study with Both a Duty Military Occupational Specialty (DMOS) and Primary Military Occupational Specialty (PMOS) in Year of Disability (DISYR)

		CASES		CONTROLS	
		N	Percent	N	Percent
TOTAL		1401		4840	
	PMOS in DISYR = DMOS in DISYR	1293	92.29	4477	92.50
	PMOS in DISYR ≠ DMOS in DISYR	108	7.71	363	7.50
MALE		821		2701	
	PMOS in DISYR = DMOS in DISYR	768	93.54	2483	91.93
	PMOS in DISYR ≠ DMOS in DISYR	53	6.46	218	8.07
FEMALE		580		2139	
	PMOS in DISYR = DMOS in DISYR	525	90.52	1994	93.22
	PMOS in DISYR ≠ DMOS in DISYR	55	9.48	145	6.78

The DMOS at year of disability was the MOS of choice because it was the occupation that the soldier performed during the year in which the disability was recorded. Frequency distributions for both men and women were computed; overall, 12.3% of the men and 20.9% of the women were missing a DMOS. Cases were more likely than controls to be missing a DMOS. (Approximately 18% of the male cases were

missing a DMOS, while 10.2% of the male controls were missing a DMOS; 32.6% of the female cases were missing a DMOS, while 17.0% of female controls were missing a DMOS.)

Because a considerable and varying percentage of cases and controls were missing a DMOS at year of disability, we turned next to the PMOS at year of disability. Only nine individuals (0.1%) were missing a PMOS. A high percentage of the men (91.9%) and the women (93.2%) had the same PMOS at year of disability and DMOS at year of disability. Therefore, fewer soldiers were missing a PMOS than were missing a DMOS, and researchers were fairly confident that the PMOS was a fairly reliable predictor of DMOS.

Next, we looked at DMOS history for the 492 men (12.3%) and the 720 women (20.9%) who were missing a DMOS for the year of disability. Researchers reviewed DMOS histories to find the last DMOS before the year of disability. Of the 492 men, 106 (19.1%) had a DMOS before year of disability. This DMOS matched the PMOS at year of disability for 88.7% of the 106 men who had a DMOS recorded before the year of disability. Of the 720 women, 83 (11.5%) had a DMOS before the year of disability. This DMOS matched the PMOS at the year of disability for 75.9% of the 83 women who had a DMOS recorded before the year of disability.

Since only about 12% of the individuals who were missing a DMOS at the year of disability had any DMOS recorded before that year, the DMOSs after the year of disability were thoroughly reviewed for the 386 men and 637 women that had no DMOS recorded up to the year of disability. As expected, very few cases had information on DMOS after the year of disability because cases were defined as individuals with a knee injury that led to disability and discharge. Therefore, controls were assessed to determine if the PMOS at the year of disability matched the DMOS in the following year. Of the 237 male controls with no DMOS up to the year of disability, 156 (65.8%) had a DMOS in the following year that matched PMOS in the year of disability. Of the 383 female controls, 196 (51.2%) had a DMOS in the following year that matched PMOS in the year of disability.

In summary, a considerable proportion of participants had missing data for DMOS at year of disability, but few were missing data for PMOS at year of disability. Over 90% of those with both of these variables had the same MOS recorded as both the primary and the duty MOS. Among those individuals who were missing a DMOS at the year of disability, the last DMOS before the year of disability matched the PMOS at the year of disability for more than 75%. Among controls without any DMOS before the year of disability, the DMOS in the following year matched the PMOS in the year of disability more than 50% of the time.

These results convinced us to use the PMOS at year of disability in all subsequent analyses. This is the occupation for which the soldier was trained rather than the occupation to which they were assigned at the time of injury. The descriptive

analyses described above showed that the PMOS is a strong correlate for the DMOS in the year of disability.

PHYSICAL TASK GROUPINGS

All analyses were stratified by gender because many jobs are closed to women, and the population for this study was selected by gender. The PMOSs in the TAIHOD are represented by a 4-digit code, with the first 3 digits representing the occupation and the last digit representing skill level. Only the first three digits were used in this study. There were 347 different 3-digit PMOSs for men and 259 for women; therefore, only the top 50 for each gender were used to make groupings based on job tasks. Frequency distributions of the controls were used to determine the 50 most common PMOSs for each gender (Tables 7 and 8). Control frequencies were chosen because controls should theoretically represent the experience of the general enlisted U.S. Army population. The individuals in these top PMOSs comprised the new dataset for this project.

Table 7. Fifty Most Common PMOSs Among Men Serving as Controls

	PMOS	MOS Title	Frequency	Percent
*	11B	Infantryman	244	8.1
*	13B	Cannon Crewmember	140	4.7
	63B	Light-Wheel Vehicle Mechanic	110	3.7
	95B	Military Police	107	3.6
	94B	Food Service Specialist	86	2.9
*	12B	Combat Engineer	74	2.5
	76Y	Unit Supply Specialist	66	2.2
	71L	Administrative Specialist	63	2.1
*	19D	Cavalry Scout	62	2.1
	64C	Motor Transport Operator	55	1.8
*	11H	Heavy Anti-armor Weapons Infantrymen	53	1.8
*	11M	Fighting Vehicle Infantrymen	53	1.8
	91B	Medical Specialist	52	1.7
*	19E	M48-M60 Armor Crewman (Reserve Component)	51	1.7
*	19K	M1 Armor Crewman	50	1.7
*	11C	Indirect Fire Infantryman	44	1.5
	91A	Medical Equipment Repairer	44	1.5
	88M	Motor Transport Operator	38	1.3
	31M	Multi-channel Transmission Systems Operator	35	1.2
	52D	Power Generation Equipment Repairer	34	1.1
	31C	Radio-Operator Maintainer	33	1.1
*	13F	Fire Support Specialist	28	0.9
	54B	Chemical Operations Specialist	26	0.9
	76C	Equipment Records and Parts Specialist	26	0.9
	77F	Petroleum Supply Specialist	25	0.8
	31V	UL Communications Maintainer	23	0.8
	76P	Materiel Control and Accounting Specialist	23	0.8
	63H	Track Vehicle Repairer	22	0.7
	63W	Wheel Vehicle Mechanic	21	0.7
	76V	Materiel Storage and Handling Specialist	21	0.7
	62E	Heavy Construction Equipment Operator	20	0.7
	75B	Personnel Administration Specialist	20	0.7
	63S	Heavy-Wheel Vehicle Mechanic	19	0.6
	75Z	Personnel Sergeant	19	0.6
*	16S	Man Portable Air Defense System Crewmember	18	0.6
	36K	Tactical Wire Operations Specialist	18	0.6
*	63T	BRADLEY Fighting Vehicle Systems Mechanic	18	0.6
	00R	Recruiter/Retention NCO	17	0.6
	91C	Practical Nurse	17	0.6
	12C	Bridge Crewmember	16	0.5
	54E	NBC Specialist	16	0.5
	67N	UH-1 Helicopter Repairer	16	0.5
*	13E	Cannon Fire Direction Specialist	15	0.5
	31K	Combat Signaler	15	0.5
	55B	Ammunition Specialist	15	0.5
	72E	Tactical Telecommunications Center Operator	15	0.5
	98G	Voice Interceptor	15	0.5
	96B	Intelligence Analyst	14	0.5
*	16P	CHAPARRAL Crewmember	13	0.4
	52C	Utilities Equipment Repairer	13	0.4

* Closed to Women

Table 8. Fifty Most Common PMOSs Among Women Serving as Controls

PMOS	MOS Title	Frequency	Percent
71L	Administrative Specialist	281	10.9
76Y	Unit Supply Specialist	116	4.5
94B	Food Service Specialist	109	4.2
91A	Medical Equipment Repairer	105	4.1
95B	Military Police	90	3.5
91B	Medical Specialist	82	3.2
76V	Materiel Storage and Handling	62	2.4
63B	Light-Wheel Vehicle Mechanic	56	2.2
75B	Personnel Administration Specialist	56	2.2
31M	Multi-channel Transmission Systems Operator	50	1.9
76P	Materiel Control and Accounting Specialist	50	1.9
75D	Personnel Records Specialist	47	1.8
72E	Tactical Telecommunications Center Operator	46	1.8
91C	Practical Nurse	45	1.7
76C	Equipment Records and Parts Specialist	40	1.6
73C	Finance Specialist	39	1.5
88M	Motor Transport Operator	39	1.5
98G	Voice Interceptor	39	1.5
75C	Personnel Management Specialist	37	1.4
64C	Motor Transport Operator	34	1.3
92B	Medical Laboratory Specialist	34	1.2
77F	Petroleum Supply Specialist	30	1.2
91E	Dental Specialist	30	1.1
71G	Patient Administration Specialist	29	1.1
75E	Personnel Actions Specialist	28	1.0
31C	Radio Operator-Maintainer	27	1.0
72G	Automatic Data Telecommunications Operator	27	1.0
98C	Signals Intelligence Analyst	27	0.9
71D	Legal Specialist	24	0.9
75Z	Personnel Sergeant	24	0.9
96B	Intelligence Analyst	23	0.8
71M	Chaplain Assistant	20	0.7
71N	Traffic Management Coordinator	19	0.7
91D	Operating Room Specialist	19	0.7
55B	Ammunition Specialist	18	0.7
36C	Wire Systems Installer	17	0.7
74C	Record Telecommunications Operator-Maintainer	17	0.7
52D	Power-Generation Equipment Repairer	16	0.6
76W	Petroleum Supply Specialist	16	0.6
31K	Combat Signaler	14	0.5
91R	Veterinary Food Inspection Specialist	14	0.5
92A	Automated Logistical Specialist	14	0.5
92Y	Unit Supply Specialist	14	0.5
54B	Chemical Operations Specialist	13	0.5
93P	Aviation Operations Specialist	13	0.5
74D	Information System Operator	12	0.5
91P	Radiology Specialist	12	0.5
54E	NBC Specialist	11	0.4
91S	Preventive Medicine Specialist	11	0.4
63H	Track Vehicle Repairer	10	0.4

Upon review of the Military Occupational Classification and Structure Manual, we learned that 17 codes had been reclassified over time. To identify physical tasks, we re-classified individuals according to the current system. Changes in MOSs are found in the Appendix (MOS Deletions/Conversions in the Military Occupational Classification and Structure Manual).[24] When the obsolete MOS was reassigned one new MOS, the change was made in the dataset. When the obsolete MOS was reassigned as two new MOSs, the obsolete MOS was given the most common new MOS. In these cases, the most common MOS was based on control frequency after all other changes had been made. Table 9 shows all such changes. All subsequent analyses were based on the dataset after these changes.

Table 9. Changes Made to PMOSs Noted as "Obsolete" in the July 1995 Version of the Military Occupation Classification and Structure Manual[24]

PMOS in Pilot Study	PMOS Title	New PMOS	New PMOS Title
31K	Combat Signaler	31U	Signal Support Systems Specialist
31M	Multi-channel Transmission Systems Operator	31R	Multi-channel Transmission Systems Operator-Maintainer
31V	UL Communications Maintainer	31U	Signal Support Systems Specialist
36C	Wire Systems Installer	31L	Cable Systems Installer-Maintainer
36K	Tactical Wire Operations Specialist	31U	Signal Support Systems Specialist
54E	NBC Specialist	54B	Chemical Operations Specialist
64C	Motor Transport Operator	88M	Motor Transport Operator
71N	Traffic Management Coordinator	88N	Transportation Management Coordinator
72E	Tactical Telecommunications Center Operator	74C	Record Telecommunications Operator-Maintainer
72G	Automated Data Telecommunications Operator	74C	Record Telecommunications Operator-Maintainer
74D	Information System Operator	74B	Information Systems Operator-Analyst
76C	Equipment Records and Parts Specialist	92A	Automated Logistical Specialist
76P	Materiel Control and Accounting Specialist	92A	Automated Logistical Specialist
76V	Materiel Storage and Handling Specialist	92A	Automated Logistical Specialist
76W	Petroleum Supply Specialist	77F	Petroleum Supply Specialist
76Y	Unit Supply Specialist	92A	Automated Logistical Specialist
92B	Medical Laboratory Specialist	91K	Medical Laboratory Specialist

Categories for grouping PMOSs, and therefore individuals, were based on the literature review and a thorough review of the physical task descriptions for each PMOS considered. Researchers abstracted information for the groupings from the physical task descriptions and coded the new variables into the dataset. These groupings

included physical demand rating, maximum weight lifted, maximum distance run/walked, maximum time walked, weight lifted and carried, climbing, pushing/pulling, standing, sitting, kneeling, and career management field (Table 10).

Table 10. Grouping Schemes Based on Physical Task Descriptions of PMOSs for the Pilot Study of the U.S. Army, 1980–1994

Grouping Scheme	Description
Career Management Field (CMF)	Assigned to each MOS. The MOSs are clustered into a CMF such that a soldier has the abilities and aptitudes for training and assignment in most of the other MOSs in that CMF.
Climbing	Selected from the physical task descriptions as the task with maximum height of climbing.
Kneeling	Selected from the physical task descriptions as the task with any kneeling.
Lift and Carry	Selected from the physical task descriptions as the task with maximum weight lifted and carried. If more than one task had this weight, the one with the farthest distance carried was selected.
Maximum Distance Run/Walked	Selected from the physical task descriptions as the task with the maximum distance run or walked, regardless of weight carried.
Maximum Time Walked	Selected from the physical task descriptions as the task with the maximum amount of walking (time in hours).
Maximum Weight Lifted	Selected from the physical task descriptions as the task with the maximum weight lifted, regardless of distance carried.
Physical Demand Rating	Given to each MOS by the U.S. Army. This is based on upper body strength demands for each MOS.
Pushing/Pulling	Selected from the physical task descriptions as the task with pushing and/or pulling.
Sitting	Selected from the physical task descriptions as the task with the maximum time spent sitting.
Standing	Selected from the physical task descriptions as the task with the maximum time spent standing.

Physical Demand Rating

The U.S. Army assigns physical demand ratings to each MOS. Physical demand ratings are based on upper body strength, with the purpose of classifying each MOS by the amount of physical activity that is required under combat conditions. The categories are “very heavy,” “heavy,” “moderately heavy,” “medium,” “light,” and “not applicable.” These were input into the database as the variable DEMAND, numbers 1–6 for each PMOS. All categories except “not applicable” are defined in Table 11. No definition for “not applicable” was found.

Table 11. Categories of Physical Demand Ratings for MOSs in the U.S. Army

Physical Demand Rating	Description
Light	Lift, on an occasional basis, a maximum of 20 pounds with frequent or constant lifting of 10 pounds.
Medium	Lift, on an occasional basis, a maximum of 50 pounds with frequent or constant lifting of 25 pounds.
Moderately Heavy	Lift, on an occasional basis, 80 pounds with frequent or constant lifting of 40 pounds.
Heavy	Lift, on an occasional basis, a maximum of 100 pounds with frequent or constant lifting of 50 pounds.
Very Heavy	Lift, on an occasional basis, over 100 pounds with frequent or constant lifting in excess of 50 pounds.

Maximum Weight Lifted

The maximum amount of weight lifted in pounds was extracted from the MOS descriptions and input into the database as the variable MAXLIFT. Groups were developed based on 25-pound increments ranging from 0–175 pounds. The category of "raises 237 pounds from a horizontal to vertical position" did not fit into this grouping scheme. This was obviously the maximum amount lifted for this PMOS, but the actual weight lifted could not be assessed.

Maximum Distance Run/Walked

This grouping scheme was developed from the maximum amount of running/walking in the physical task descriptions for each MOS. Many of the MOSs had distances given in feet or miles, which were input into the database as the variable MAXFEET. The distances ranged from 0–25 miles. After a frequency distribution was performed, eight categories were made. These categories were "none," "1–25 feet," "25-50 feet," "51–100 feet," "101–500 feet," "0.25–1.0 miles," "3.0 miles," and "25 miles." Other PMOSs did not have precise distances in the physical task descriptions, but it was clear that "none'" was inappropriate, since movement was taking place. These categories were retained in their original form.

Maximum Time Walked

The maximum time walked was defined by selecting the amount of walking (as time in hours) and adding it to the database as the MAXTIME variable. The three categories were "2 of 6 hours," "4 hours duration," and "none."

Lift and Carry

This grouping scheme was developed to incorporate the dual effects of lifting weight and carrying it some distance. This variable was not accounted for in Maximum Weight Lifted or Maximum Distance Run/Walked, which were assessed without consideration of each other.

The physical task descriptions were reviewed to determine the task for each MOS that incorporated both lifting and carrying. When more than one task had both lifting and carrying, the following rules applied. First, the task involving lifting the heaviest weight was chosen. Second, if there was more than one task with this weight, the longest distance the weight was carried was chosen.

When there was no task with both lifting and carrying, the following rules applied: First, the task with the heaviest weight was chosen. Second, if there was no lifting and carrying and no weight lifted, then the task with the longest distance run/walked was chosen. Third, if there was no lifting or carrying, "no lift/no carry" was designated. These categories were created because it would have been inappropriate to include PMOSs with tasks that had either lifting or carrying in the same category with PMOSs that had neither.

The information on lifting and carrying was input as two variables, which were called LIFT and CARRY. The two variables were cross-tabulated to determine where they overlapped. From this, a grouping scheme was determined in the following way. Lifting was grouped in 25-pound intervals ranging from 0–175 pounds. Carrying was grouped as "no carrying," "carries," "carries short distance," "carries 1–25 feet," "carries 26–50 feet," "carries 51–100 feet," "carries 101–500 feet," "carries 0.25–1.0 miles," "carries 25 miles," "carries long distance," and "pivots." The categories for lifting and carrying were cross-tabulated to determine 43 of the 44 final categories that incorporated both lifting and carrying. One category was left alone because it did not fit into this scheme. This was "lifts 171 pounds and pivots," which was the only category with any mention of pivoting.

Kneeling

Kneeling groups were developed through a review of the PMOS task descriptions for tasks that required any type of kneeling. A variable KNEEL was created in the database, and contained one of the following seven codes: "none," "kneels to file," "kneels for 4 hours duration," "kneels for prolonged periods," "shovels 10-pound scoops of dirt in kneeling position," "shovels 21-pound scoops of dirt in kneeling position," and "lifts, pushes, and pulls 50 pounds in bent, stooped, or kneeling position."

Climbing

Climbing groups were developed from the physical tasks that described height climbed in feet. These were input into the database as the variable CLIMB. The eight categories were "none," "3 feet," "9 feet," "10 feet," "11 feet," "30 feet," "40 feet," and "50 feet."

Pushing/Pulling

The maximum amount pushed or pulled was chosen from the MOS task descriptions to make this grouping scheme. The amount described was input into the database as the variable PUSHPULL. There were 19 different categories, which included weights of 30 pounds to 474 pounds, forces of 50 feet per pound to 600 feet per pound, "pushing/pulling a wrench," and "no pushing/pulling."

Sitting

Sitting groups were developed from the physical task of each PMOS that required sitting. It was input into the database as the variable SIT. The five categories, taken directly from the MOS description, were "none," "4 hours," "5 hours," "6 hours," and "8 hours" duration.

Standing

The task for each PMOS that required the most standing was input into the database as the variable STAND. The eight categories were "none," "1 hour," "2 hours," "4 hours," "8 hours," "stands," "stands for extended periods," and "stands for prolonged periods." Although the last three categories are vague, it would have been inappropriate to group them under "none" or with any of the more specific categories.

Career Management Field

Career Management Field (CMF) is a 2-digit code given to each MOS for the purpose of grouping MOSs in related fields. The MOSs are related to each other so that "soldiers serving in one specialty have the potential abilities and aptitudes for training and assignment in most of the other specialties in that field."[24] The Career Management Fields and the PMOSs from this study that were grouped together under each CMF are shown in Table 12.

Table 12. Career Management Fields (CMF) and Associated PMOSs

CMF	CMF Title	PMOSs	MOS Title
11	Infantry	11B	Infantrymen
		11C	Indirect Fire Infantrymen
		11H	Heavy Anti-armor Weapons Infantrymen
		11M	Fighting Vehicle Infantrymen
12	Combat Engineering	12B	Combat Engineer
		12C	Bridge Crewmember
13	Field Artillery	13B	Cannon Crewmember
		13E	Cannon Fire Direction Specialist
		13F	Fire Support Specialist
14	Air Defense Artillery	16P	CHAPARRAL Crewmember
		16S	Man Portable Air Defense System Crewmember
19	Armor	19D	Cavalry Scout
		19E	M48-M60 Armor Crewman
		19K	M1 Armor Crewman
31	Signal Operations	31C	Radio-Operator Maintainer
		31L	Cable Systems Installer-Maintainer
		31R	Multi-channel Transmission Systems Operator
		31U	Signal Support Systems Specialist
51	General Engineer	62E	Heavy Construction Equipment Operator
54	Chemical	54B	Chemical Operations Specialist
55	Ammunition	55B	Ammunition Specialist
63	Mechanical Maintenance	52C	Utilities Equipment Repairer
		52D	Power Generation Equipment Repairer
		63B	Light-Wheel Vehicle Mechanic
		63H	Track Vehicle Repairer
		63S	Heavy-Wheel Vehicle Mechanic
		63T	BRADLEY Fighting Vehicle Systems Mechanic
		63W	Wheel Vehicle Mechanic
67	Aircraft Maintenance	67N	UH-1 Helicopter Repairer
71	Administration	71D	Legal Specialist
		71L	Administrative Specialist
		71M	Chaplain Assistant
		73C	Finance Specialist
		75B	Personnel Administration Specialist

Table 12. continued

CMF	CMF Title	PMOSs	MOS Title
		75C	Personnel Management Specialist
		75D	Personnel Records Specialist
		75E	Personnel Actions Specialist
		75Z	Personnel Sergeant
74	Record Information Operations	74B	Information Systems Operator-Analyst
		74C	Record Telecommunications Operator-Maintainer
77	Petroleum and Water	77F	Petroleum Supply Specialist
79	Recruitment and Re-enlistment	00R	Recruiter/Retention NCO
88	Transportation	88M	Motor Transport Operator
		88N	Transportation Management Coordinator
91	Medical	71G	Patient Administration Specialist
		91A	Medical Equipment Repairer
		91B	Medical Specialist
		91C	Practical Nurse
		91D	Operating Room Specialist
		91E	Dental Specialist
		91K	Medical Laboratory Specialist
		91P	Radiologist Specialist
		91R	Veterinary Food Inspection Specialist
		91S	Preventive Medicine Specialist
92	Supply and Services	92A	Automated Logistical Specialist
		92Y	Unit Supply Specialist
93	Aviation Operations	93P	Aviation Operations Specialist
94	Food Services	94B	Food Service Specialist
95	Military Police	95B	Military Police
96	Military Intelligence	96B	Intelligence Analyst
98	Signals Intelligence/ Electronic Warfare Operations	98C	Signals Intelligence Analyst
		98G	Voice Interceptor

STRATIFIED ANALYSIS

All analyses were stratified by gender because many MOSs are closed to women. Further stratification by race and age was performed on all of the groups because preliminary analyses showed that both race and age were effect modifiers. Race was categorized as white and non-white. Age was grouped in quintiles of 17–20 years old, 21–22 years old, 23–26 years old, 27–30.35 years old, and 30.36–54 years old. Odds ratios and 95% confidence intervals were calculated for all the stratified groups.

SAS version 6.12[25] was used for all data management, data entry, frequency distributions, and cross-tabulations. Epi Info version 6.0b[26] was used to calculate odds ratios and 95% confidence intervals. The referent group for all of the grouping schemes was "none," except for physical demand rating, which had "very heavy" as the referent category. Very heavy was used because it was the largest group and was present in both genders.

LOGISTIC REGRESSION

Stata version 5.0[27] was used for all logistic regression modeling in this report. First, dummy variables were created for all categorical variables. Second, univariate models with odds ratios, 95% confidence intervals, p-values, and likelihood ratio tests were calculated. Odds ratios and trends were evaluated to determine which variables would be included in the logistic regression models. Variables were not included in the model if there was no detectable trend in the odds ratios as the levels of the variable changed, or if there was some level of colinearity with another variable. The variables that were excluded because of lack of trend in the odds ratios were maximum distance run/walked, maximum time walked, and height climbed. The odds ratios for these variables fluctuated up and down as the activity levels within the category increased; therefore, no logical trend was established. The variables that were excluded because of colinearity with another variable were Career Management Field, carry/lift, and physical demand rating. Carry/lift and physical demand rating measured amounts of lifting, which was also measured by maximum weight lifted. They were excluded since maximum weight lifted had a stronger univariate trend. Career Management Field was excluded because some of the levels fell out of the model when maximum weight lifted was included.

The odds ratios for the other categories were evaluated to determine if groups could be collapsed. Groups were collapsed when it was logical and the odds ratios were similar. Categories were collapsed within the variables of kneeling, sitting, standing, and pushing/pulling. The four new groups of kneeling were prolonged periods or 4 hours duration, while shoveling 10 pounds or 21 pounds, to file, and none. The two new groups of sitting were sitting and no sitting. The two new groups of standing were standing and no standing. The five new groups of pushing/pulling were less than 130

pounds, greater than or equal to 130 pounds, any feet per pound of force, pushing or pulling a wrench, and none.

Although models for each gender were assessed separately, the same variables were included in both the male model and the female model. These variables were race, age, maximum weight lifted, pushing/pulling, kneeling, sitting, and standing. A full model was calculated, and each variable was removed one at a time to determine the effect on the other variables. A variable was kept in the model if it caused a 20% change in the coefficient of any other variable after removal. Changes in odds ratios were also calculated. After the final model for each gender was established, the fit was calculated using the Hosmer-Lemeshow Goodness of Fit Test.[28]

RESULTS

FIFTY MOST COMMON PMOSs

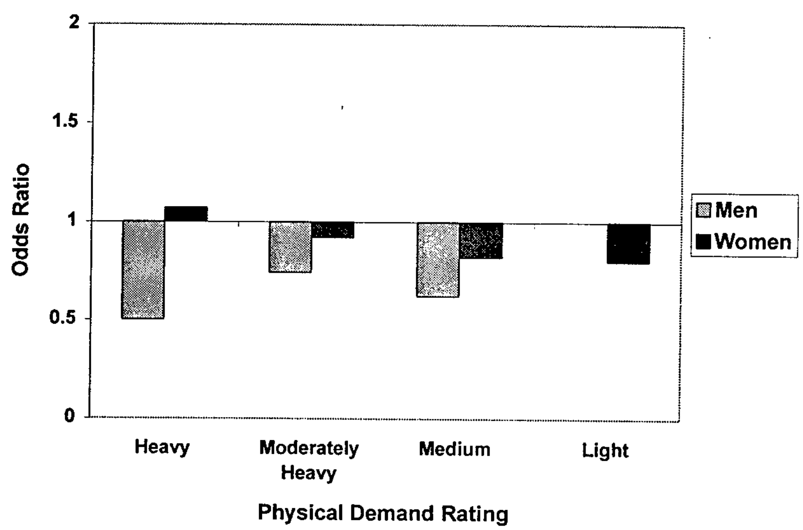
The pilot study included 7,454 individuals, of whom 4,014 were men and 3,440 were women. After selecting the individuals in the 50 PMOSs with the largest number of individuals for each gender, the dataset for this report was reduced to 2,768 men and 2,632 women. The top 50 PMOSs for men serving as controls accounted for 67.8% of the control men in the pilot study. The top 50 PMOSs for women serving as controls accounted for 77.9% of the control women in the pilot study.

STRATIFIED ANALYSIS

Physical Demand Rating

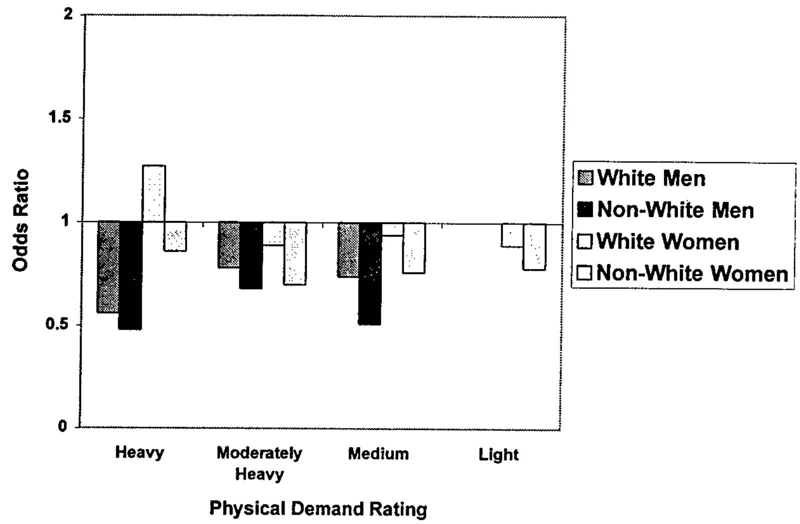
There was no clear trend in the association disabling knee disability discharge and increasing physical demand, although differences among categories were seen (Figure 2). The "very heavy" category was the referent group, and all other categories had odds of injury less than this category, except for women in the "heavy demand" group. There were no PMOSs represented in the top 50 for men that had a physical demand rating of "light." "Heavy" had the lowest estimate with an odds ratio of 0.50 (95% CI = 0.30–0.78). Among women there was more evidence of an inverse trend in the association between decreasing physical demand and disability risk.

Figure 2. Relative Odds of Knee-Related Disability Discharge with Decreasing Physical Demand Rating for Men and Women in the U.S. Army, 1980–1994



For both genders, non-whites had a lower risk than whites for all demand categories (Figure 3). The numbers became very small for each stratum in the analysis with stratification by age.

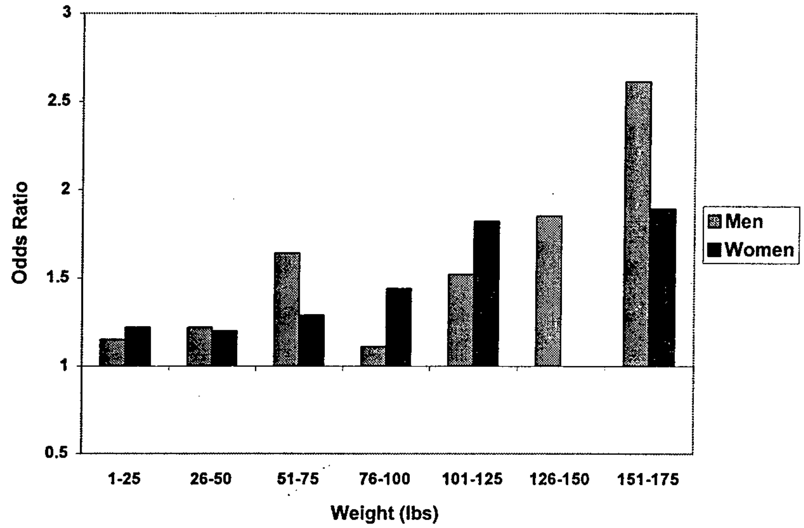
Figure 3. Relative Odds of Knee-Related Disability Discharge with Decreasing Physical Demand Rating for Men and Women in the U.S. Army, Stratified by Race, 1980–1994



Maximum Weight Lifted

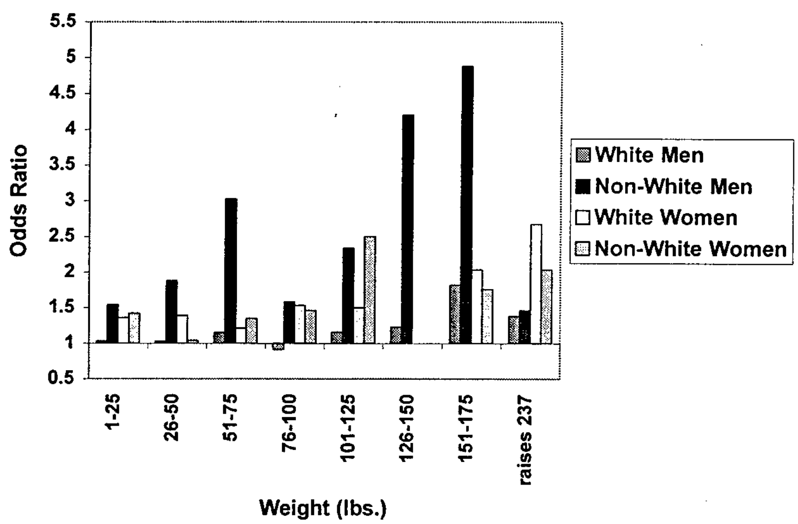
There is a clear trend for both men and women that shows increasing odds of disability discharge as the amount of weight lifted increases (Figure 4). Men in the heaviest category (151–175 pounds of weight) had an odds ratio of 2.61 (95% CI = 1.53–4.63) compared to men in the "no weight lifted" category. Among women, there were no PMOSs that had 126–150 pounds of maximum weight lifted, which accounts for the gap in the Figure 4. Women in the heaviest category of 151–175 pounds had an odds ratio of 1.89 (95% CI = 1.01–3.52) compared to women in the "no weight lifted" category.

Figure 4. Relative Odds of Knee-Related Disability Discharge with Increasing Amounts of Maximum Weight Lifted Compared to No Weight Lifted for Men and Women in the U.S. Army, 1980–1994



These trends varied by race (Figure 5). Among non-white men there was a trend of increasing risk with increasing weight lifted, with an odds ratio of 4.88 (95% CI = 1.83–16.34) for men in the heaviest category. There was not as strong a trend for white men, with the point estimate of 1.82 (CI = 0.95–3.68) in the heaviest category. For women, racial differences in risk were not as pronounced as those observed for men.

Figure 5. Relative Odds of Knee-Related Disability Discharge with Increasing Amounts of Maximum Weight Lifted Compared to No Weight Lifted for Men and Women in the U.S. Army, Stratified by Race, 1980–1994



There were also age differences in the risk of disability discharge across categories of maximum weight lifted (Figures 6 and 7). In general, age groups had an increased risk of disability discharge with increasing weight. Also, weight categories had a general increased risk of disability discharge as age increased.

Figure 6. Relative Odds of Knee-Related Disability Discharge with Increasing Amounts of Maximum Weight Lifted Compared to No Weight Lifted for Men in the U.S. Army, Stratified by Age in Years, 1980–1994

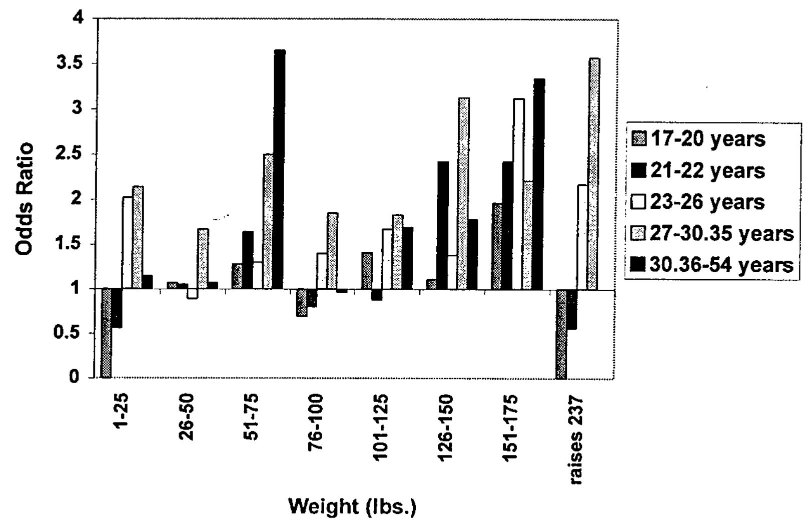
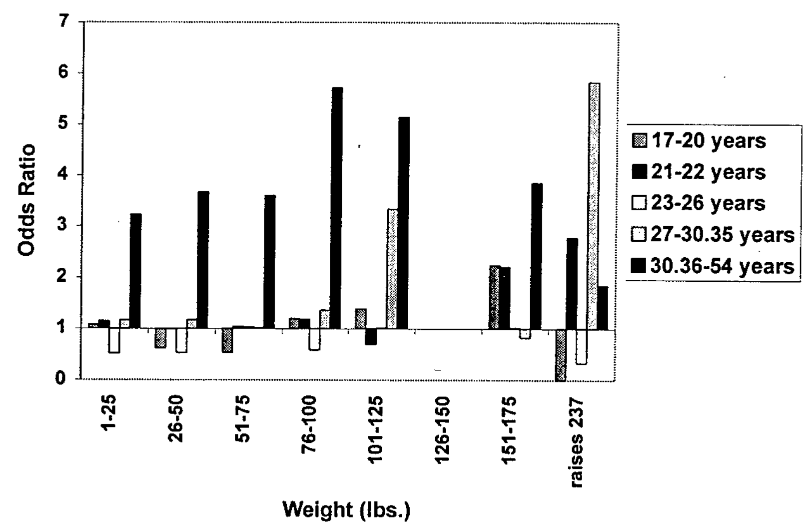


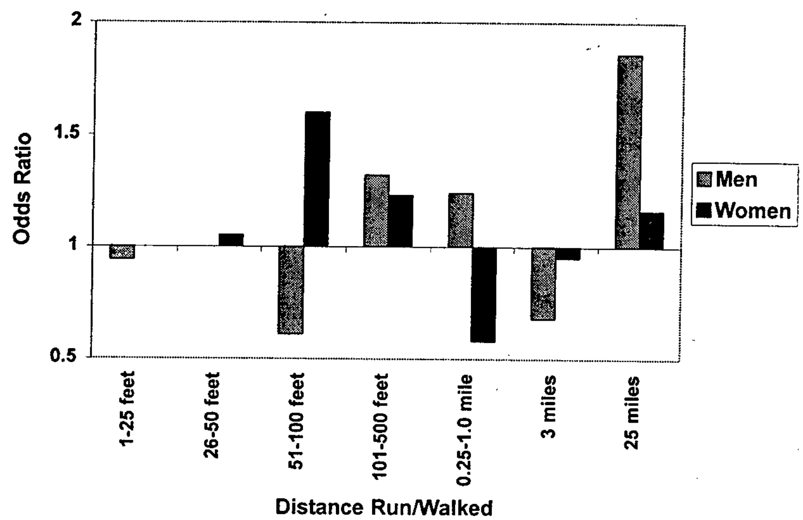
Figure 7. Relative Odds of Knee-Related Disability Discharge with Increasing Amounts of Maximum Weight Lifted Compared to No Weight Lifted for Women in the U.S. Army, Stratified by Age in Years, 1980–1994



Maximum Distance Run/Walked

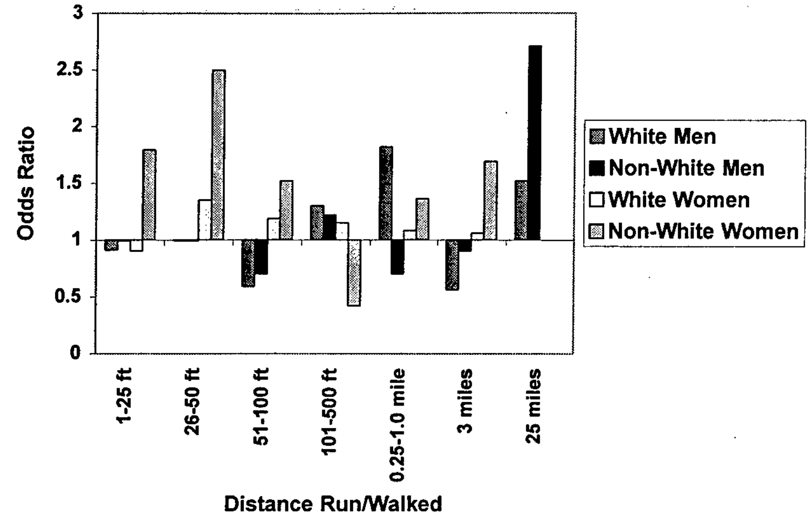
There was no trend of increased or decreased risk of knee-related disability discharge with increasing distance run/walked for either gender (Figure 8). The 25-mile category had the highest odds ratio (1.86) for the men and was statistically significant. The 51–100 feet category had the highest odds ratio (1.60) for the women and was statistically significant.

Figure 8. Relative Odds of Knee-Related Disability Discharge with Increasing Levels of Maximum Distance Run/Walked Compared to No Running/Walking for Men and Women in the U.S. Army, 1980–1994



There was no trend in distance run/walked by category of race. Among women, most of the categories had higher odds ratios for non-white women than for white women, but there was no overall trend for non-white women (Figure 9). In general, white women had lower odds ratios for all levels of walking/running.

Figure 9. Relative Odds of Knee-Related Disability Discharge with Increasing Levels of Maximum Distance Run/Walked Compared to No Running/Walking for Men and Women in the U.S. Army, Stratified by Race, 1980–1994



Among men, there were generally higher odds ratios within each age group as the distance increased, with the exception of the 3-mile category (Figure 10). Among women, there was no trend within age groups as distances increased, but within distance categories the risk of knee injury increased as age increased (Figure 11).

Figure 10. Relative Odds of Knee-Related Disability Discharge with Increasing Levels of Maximum Distance Run/Walked Compared to No Running/Walking for Men in the U.S. Army, Stratified by Age in Years, 1980–1994

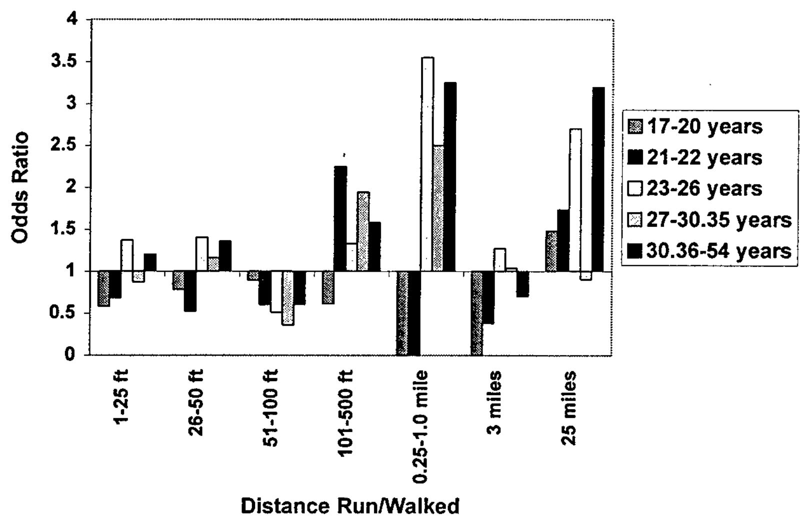
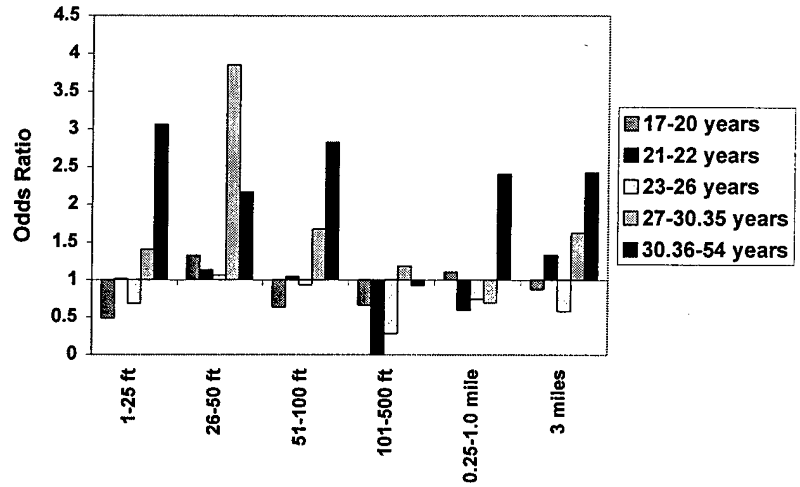
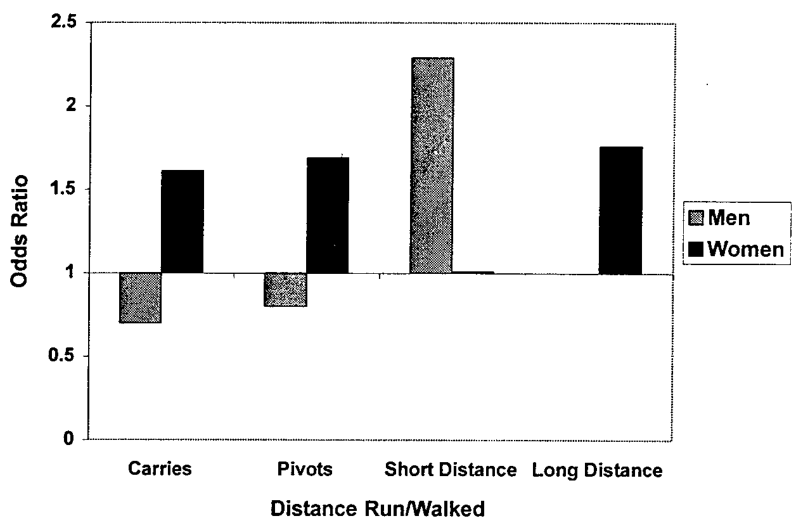


Figure 11. Relative Odds of Knee-Related Disability Discharge with Increasing Levels of Maximum Distance Run/Walked Compared to No Running/Walking for Women in the U.S. Army, Stratified by Age in Years, 1980–1994



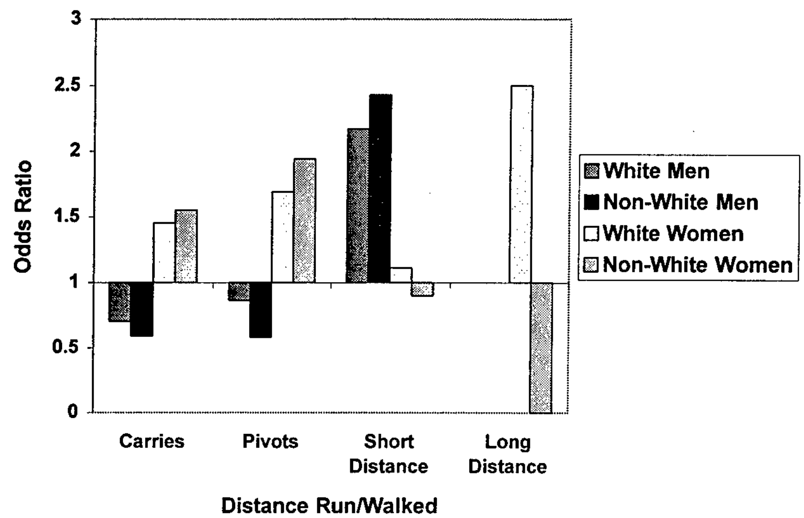
The other maximum distance categories that were more vague in description were also analyzed (Figure 12). There were no PMOSs with a task description of "long distance" as the maximum distance moved for men. Only "walks or runs a short distance" had an odds ratio greater than 1.0 among men. All the categories had odds ratios greater than 1.0 among women.

Figure 12. Relative Odds of Knee-Related Disability Discharge with Other Maximum Distance Run/Walked Groups Compared to No Running/Walking for Men and Women in the U.S. Army, 1980–1994



There was no clear trend of racial differences for either gender, although there was a large difference between white and non-white women in the long distance category (Figure 13).

Figure 13. Relative Odds of Knee-Related Disability Discharge with Other Maximum Distance Run/Walked Groups Compared to No Running/Walking for Men and Women in the U.S. Army, Stratified by Race 1980–1994



There were differences between odds of disability discharge for each age group for varying distances walked (Figures 14 and 15). As age increased, odds of a disabling knee injury increased for most categories of distance run/walked.

Figure 14. Relative Odds of Knee-Related Disability Discharge with Other Maximum Distance Run/Walked Groups Compared to No Running/Walking for Men in the U.S. Army, Stratified by Age in Years 1980–1994

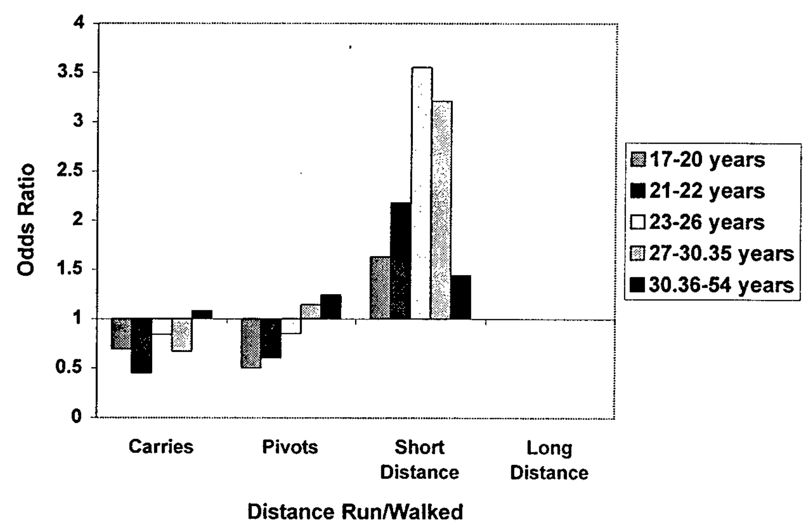
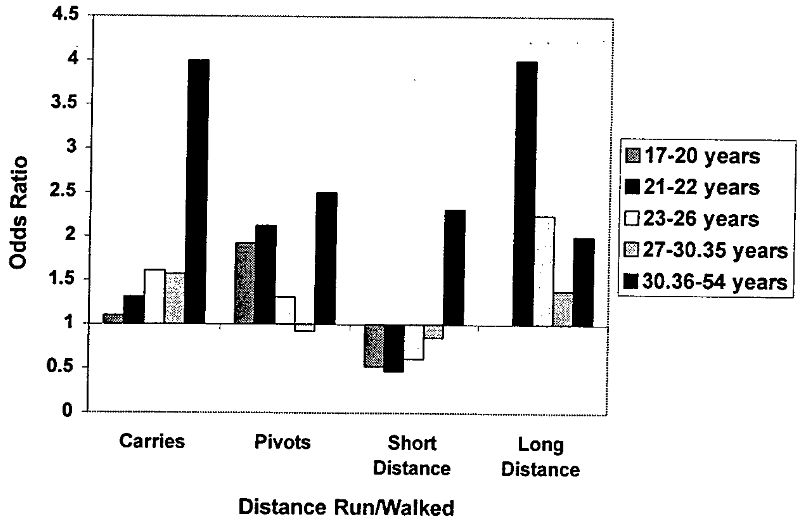


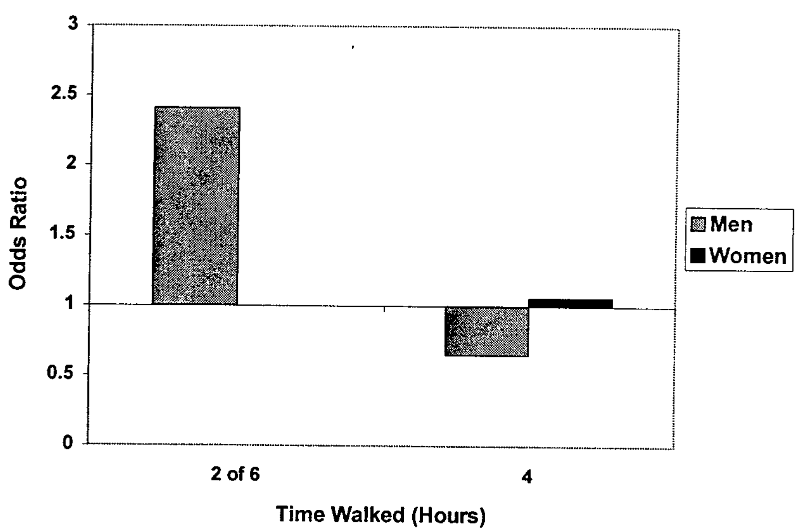
Figure 15. Relative Odds of Knee-Related Disability Discharge with Other Maximum Distance Run/Walked Groups Compared to No Running/Walking for Women in the U.S. Army, Stratified by Age in Years 1980–1994



Maximum Time Walked

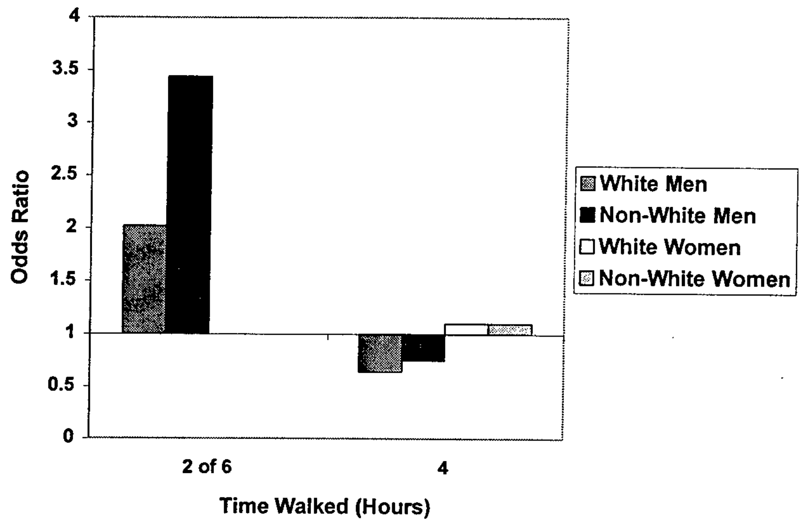
Compared to men in jobs requiring no walking, men with a maximum walking time of "2 of 6 hours" demonstrated an increased risk of disability, and men in the "4 hours" category demonstrated decreased risk. There were no women in the "2 of 6 hours" category, but the category of "4 hours" duration had an increased risk compared to "none" (Figure 16).

Figure 16. Relative Odds of Knee-Related Disability Discharge with Maximum Time Walked Compared to No Time Walked for Men and Women in the U.S. Army, 1980–1994



Among men, non-whites had higher odds ratios than whites (Figure 17).

Figure 17. Relative Odds of Knee-Related Disability Discharge with Maximum Time Walked Compared to No Time Walked for Men and Women in the U.S. Army, Stratified by Race, 1980–1994



Among men, the odds ratios generally increased with age in the "2 to 6 hour" category. In contrast, the odds ratio decreased with age in the "4 hours" category (Figure 18). Among women, the odds ratios were found to increase with age (Figure 19).

Figure 18. Relative Odds of Knee-Related Disability Discharge with Maximum Time Walked Compared to No Time Walked for Men in the U.S. Army, Stratified by Age in Years, 1980–1994

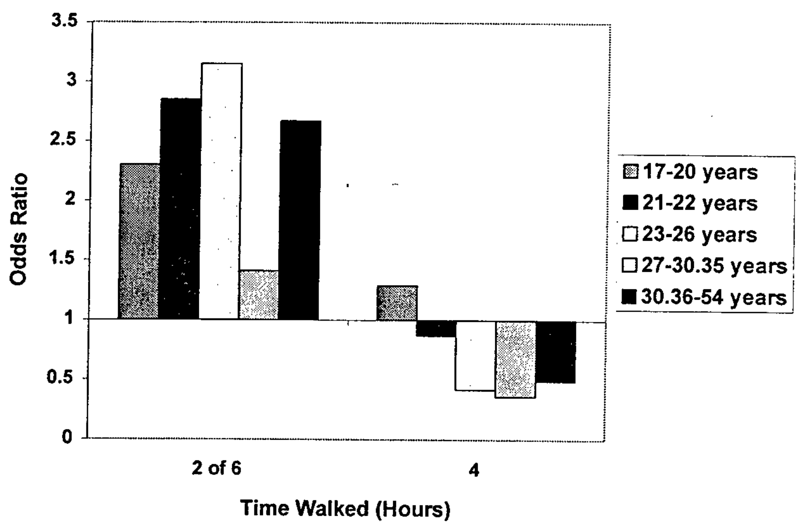
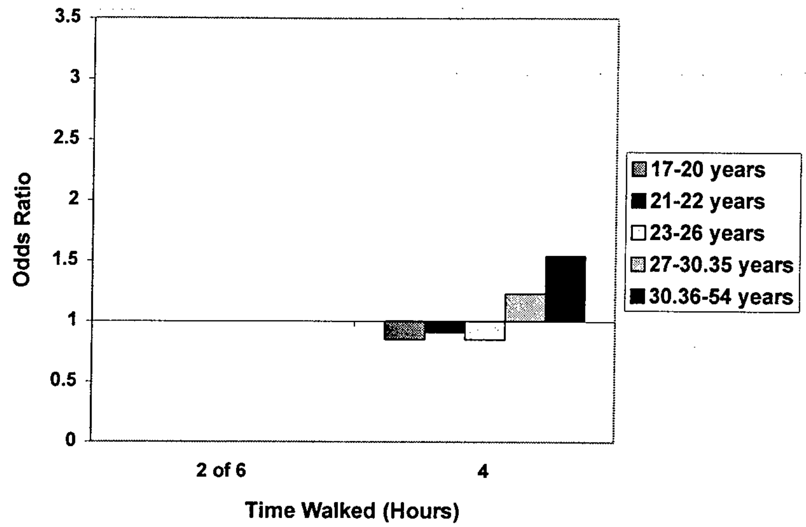


Figure 19. Relative Odds of Knee-Related Disability Discharge with Maximum Time Walked Compared to No Time Walked for Women in the U.S. Army, Stratified by Age in Years, 1980–1994



Lift and Carry

Only odds ratios within gender were calculated for this grouping scheme, because the numbers became too small with further stratification. There was a slight increase in odds ratio as the loads lifted and carried increased in men, but there were many fluctuations (Figure 20). For women, there was no obvious trend, with many fluctuations between the categories (Figure 21).

Figure 20. Relative Odds of Knee-Related Disability Discharge with Lift and Carry Groups Compared to No Lifting/No Carrying for Men in the U.S. Army, 1980–1994

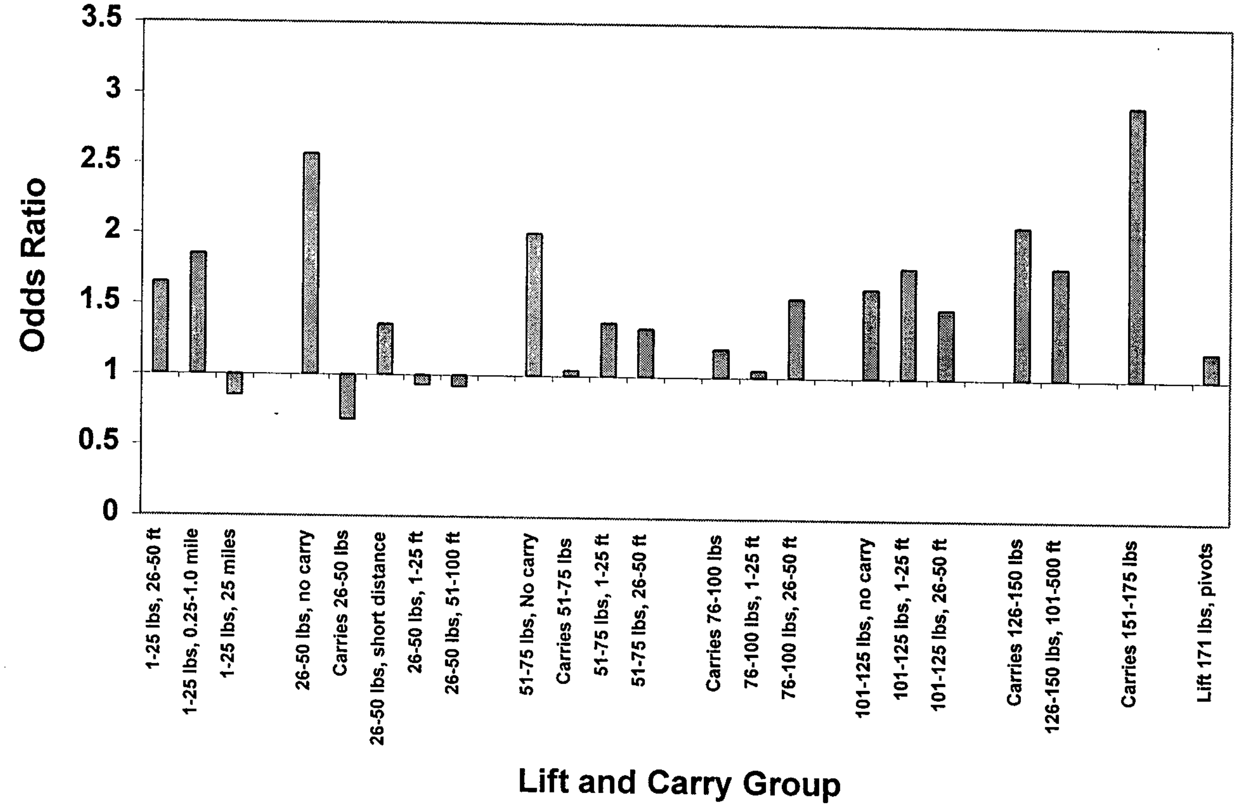
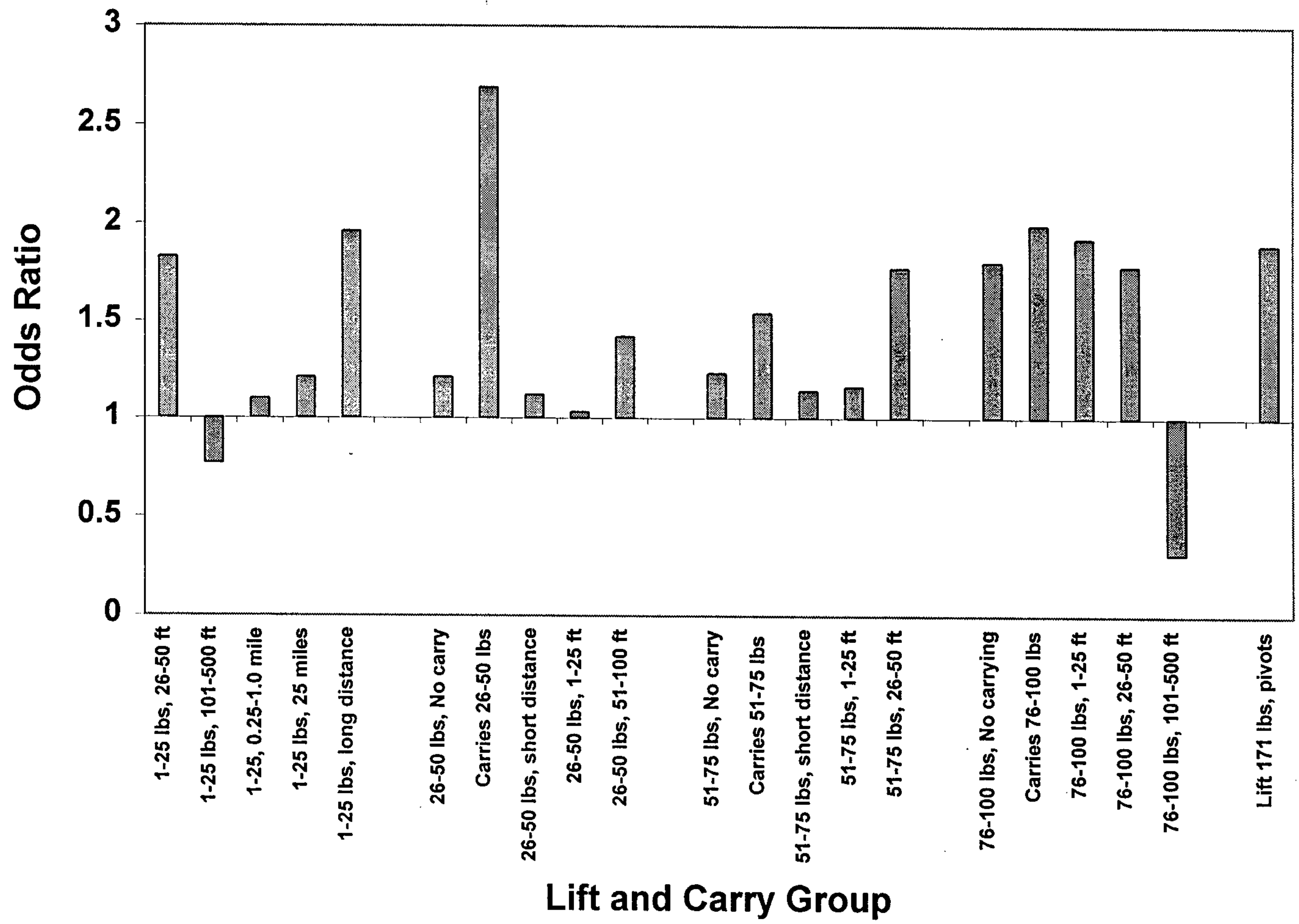


Figure 21. Relative Odds of Knee-Related Disability Discharge with Lift and Carry Groups Compared to No Lifting/No Carrying for Women in the U.S. Army, 1980–1994



Career Management Field

There was no clear referent group for the CMF grouping scheme. For the stratified analysis, CMF 71, which was Administration, was chosen because it was present in both genders and had high numbers of individuals for both genders. Compared to this category, most of the other CMFs populated by both men and women had odds ratios above unity (Table 13).

Table 13. Career Management Field Groups (CMF) Compared to CMF 71, Administration

		MEN		WOMEN	
CMF	CMF Title	OR*	95% CI†	OR*	95% CI†
11	Infantry	3.24	(1.93–5.66)		
12	Combat Engineer	2.10	(1.09–4.10)		
13	Field Artillery	1.87	(1.05–3.44)		
14	Air Defense Artillery	1.49	(0.68–3.08)		
19	Armor	1.60	(0.87–2.99)		
31	Signals Operator	1.65	(0.87–3.16)	1.72	(1.14–2.56)
51	General Engineer	2.29	(0.80–6.22)		
54	Chemical	1.46	(0.59–3.46)	1.93	(0.86–4.12)
55	Ammunition	1.02	(0.17–4.11)	1.07	(0.31–3.06)
63	Mechanical Maintenance	1.12	(0.80–1.57)	1.74	(1.10–2.72)
67	Aircraft Maintenance	1.27	(0.28–4.54)		
71	Administration	1.00‡		1.00‡	
74	Record Information Operations	1.02	(0.17–4.11)	1.14	(0.70–1.80)
77	Petroleum and Water	1.63	(0.55–4.43)	1.43	(0.74–2.63)
79	Recruitment and Re-enlistment	0.90	(0.15–3.56)		
88	Transportation	1.32	(0.65–2.69)	1.51	(0.96–2.35)
91	Medical	1.40	(0.72–2.76)	1.09	(0.82–1.46)
92	Supply and Services	1.35	(0.71–2.61)	0.89	(0.63–1.23)
93	Aviation Operations			0.30	(0.01–2.01)
94	Food Services	1.01	(0.46–2.17)	1.28	(0.81–1.97)
95	Military Police	1.10	(0.54–2.24)	1.84	(1.20–2.81)
96	Military Intelligence	1.82	(0.46–6.14)	1.68	(0.70–3.76)
98	Signals Intelligence/ Electronic Warfare Operations	2.04	(0.57–6.42)	1.81	(1.10–2.94)

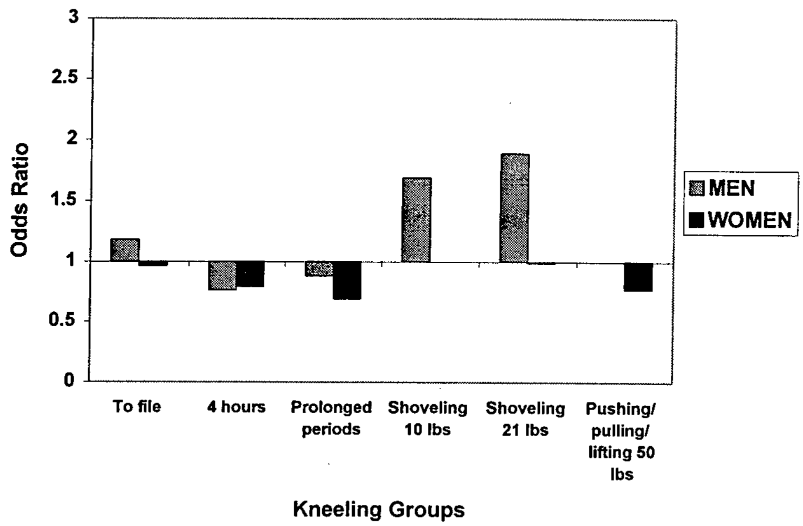
* Odds ratio
† 95% Confidence interval
‡ Referent group

Kneeling

There were odds ratios above and below unity for the kneeling groups (Figure 22). Among men, "kneeling to file," "kneeling while shoveling 21 pounds," and "kneeling while shoveling 10 pounds" all had odds ratios greater than 1.0. "Kneeling for 4 hours" and "kneeling for prolonged periods" had odds ratios less than 1.0. There were no men who "knelt while pushing, pulling, or lifting 50 pounds." Among women, all

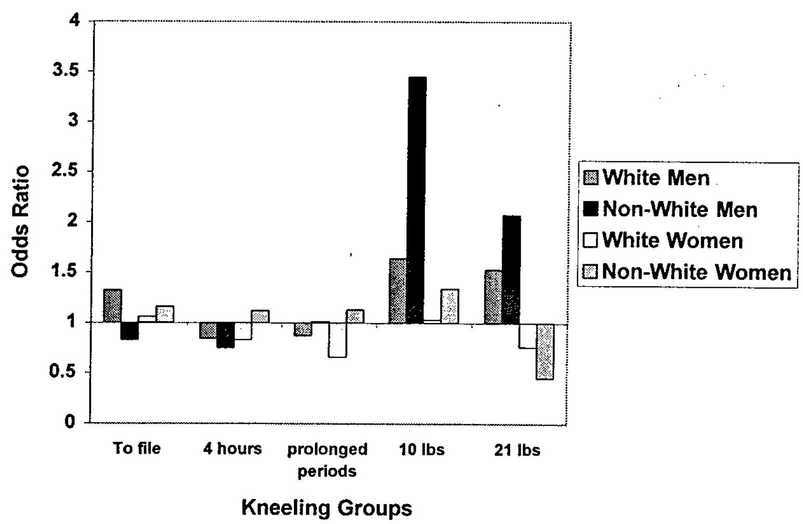
the categories except "kneeling while shoveling 21 pounds" had an odds ratio less than 1.0. There were no women who "knelt while shoveling 10 pounds."

Figure 22. Relative Odds of Knee-Related Disability Discharge with Kneeling Groups Compared to No Kneeling for Men and Women in the U.S. Army, 1980–1994



There were no clear trends in differences by race.

Figure 23. Relative Odds of Knee-Related Disability Discharge with Kneeling Groups Compared to No Kneeling for Men and Women in the U.S. Army, Stratified by Race, 1980–1994



Climbing

The climbing categories had no clear trend as the height of climbing increased (Figures 24 and 25).

Figure 24. Relative Odds of Knee-Related Disability Discharge with Increasing Height Climbed Compared to No Climbing for Men in the U.S. Army, 1980–1994

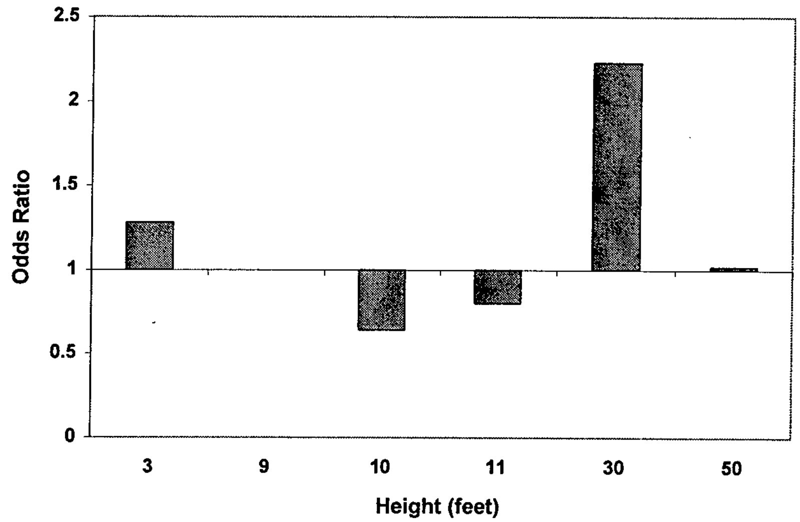
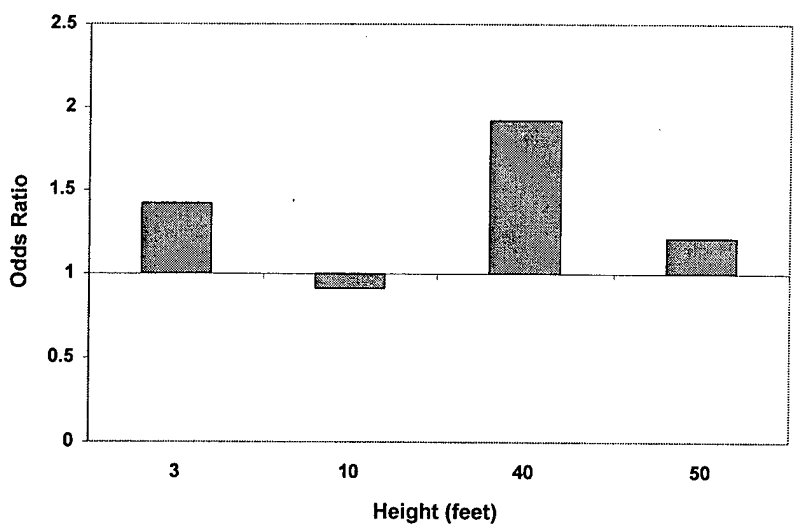


Figure 25. Relative Odds of Knee-Related Disability Discharge with Increasing Height Climbed Compared to No Climbing for Women in the U.S. Army, 1980–1994



Non-whites tended to have higher odds ratios than whites for both genders (Figures 26 and 27). The numbers in each strata were small when stratified by age group.

Figure 26. Relative Odds of Knee-Related Disability Discharge with Climbing Groups Compared to No Climbing for Men in the U.S. Army, Stratified by Race, 1980–1994

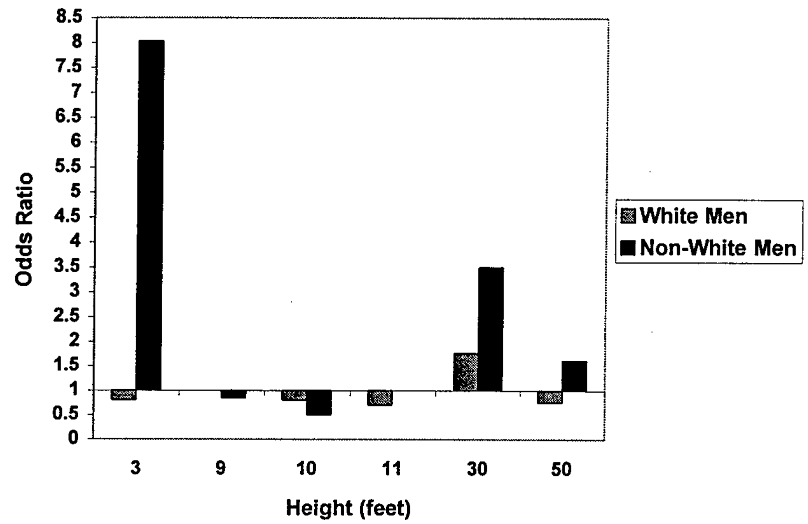
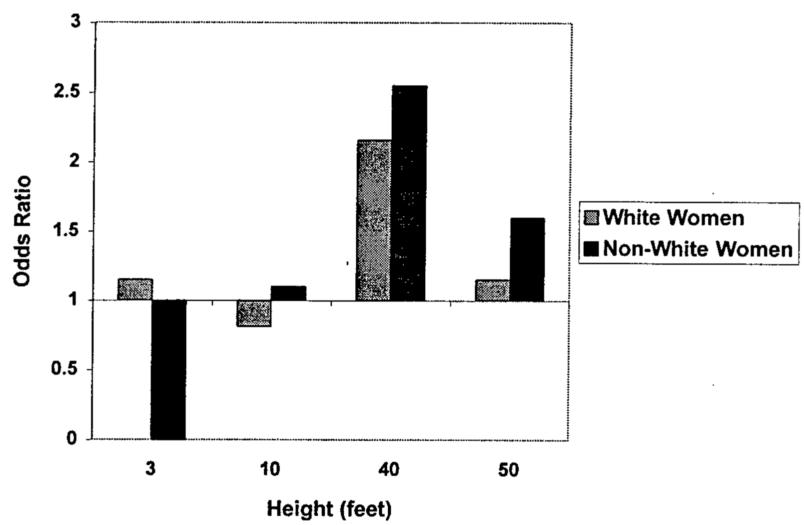


Figure 27. Relative Odds of Knee-Related Disability Discharge with Climbing Groups Compared to No Climbing for Women in the U.S. Army, Stratified by Race, 1980–1994



Sitting and Standing

The grouping schemes of sitting and standing had no clear trends, but most odds ratios were below 1.0 (Figures 28–31). The only exception was for women where "standing for extended periods" had an odds ratio above unity.

Figure 28. Relative Odds of Knee-Related Disability Discharge with Increasing Duration of Sitting Compared to No Sitting for Men and Women in the U.S. Army, 1980–1994

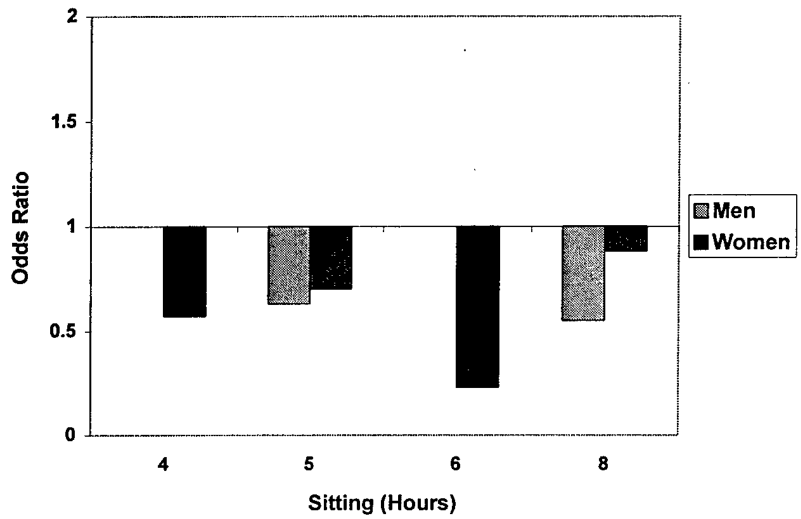


Figure 29. Relative Odds of Knee-Related Disability Discharge with Increasing Duration of Sitting Compared to No Sitting for Men and Women in the U.S. Army, Stratified by Race, 1980–1994

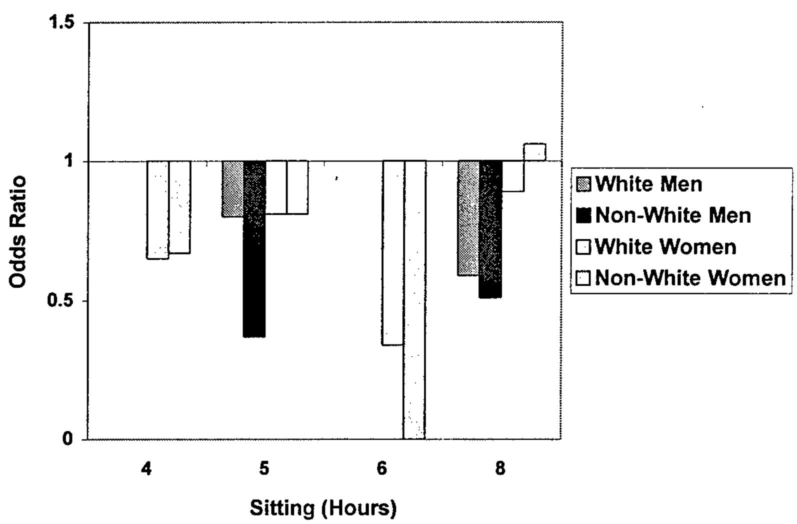


Figure 30. Relative Odds of Knee-Related Disability Discharge with Increasing Duration of Standing Compared to No Standing for Men and Women in the U.S. Army, 1980–1994

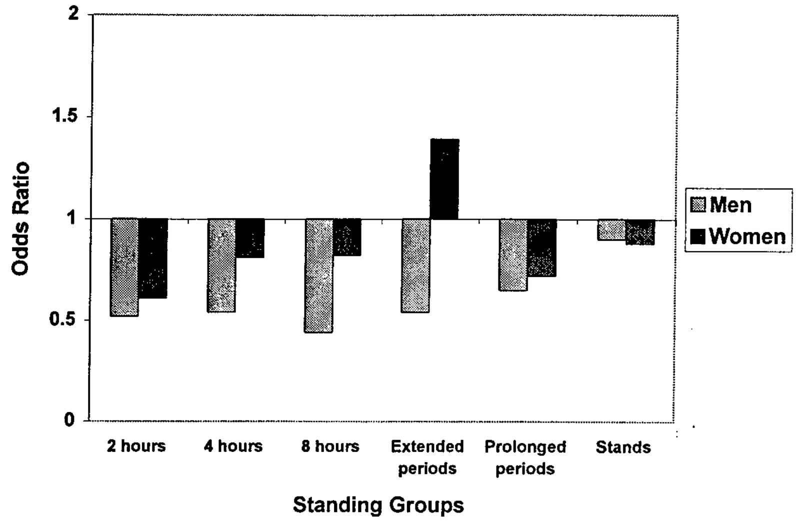
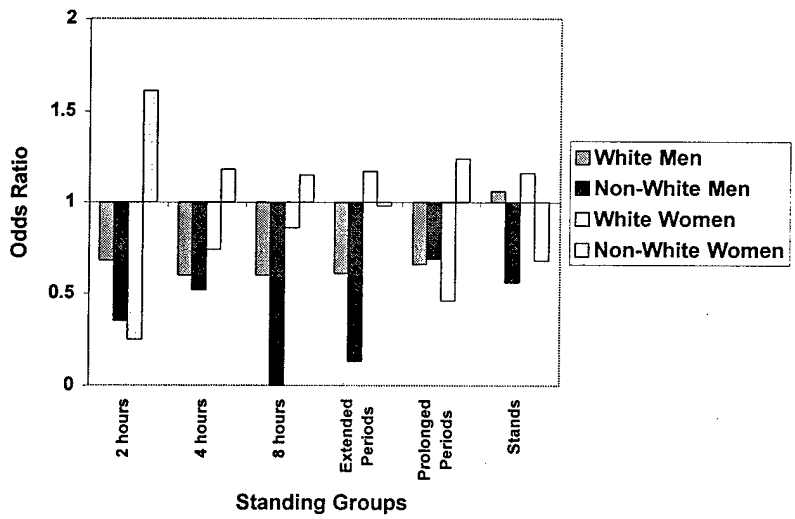


Figure 31. Relative Odds of Knee-Related Disability Discharge with Increasing Duration of Standing Compared to No Standing for Men and Women in the U.S. Army, Stratified by Race, 1980–1994



Pushing/Pulling

There were slight differences in the trends for pushing and pulling among men and women. Among men, almost all the categories were below unity. The categories that were above unity were 42.5 pounds and 250 pounds (Figure 32). This was not a clear trend. Among women, there was a more distinct trend (Figure 32). The odds ratios for categories less than 130 pounds were approximately unity or below unity. The odds ratios for categories greater than or equal to 130 pounds were greater than unity. The odds ratios for the categories of feet per pound of force were all above unity. This suggests a threshold at approximately 130 pounds.

Figure 32. Relative Odds of Knee-Related Disability Discharge with Pushing/Pulling Groups Compared to No Pushing/Pulling for Men and Women in the U.S. Army, 1980–1994

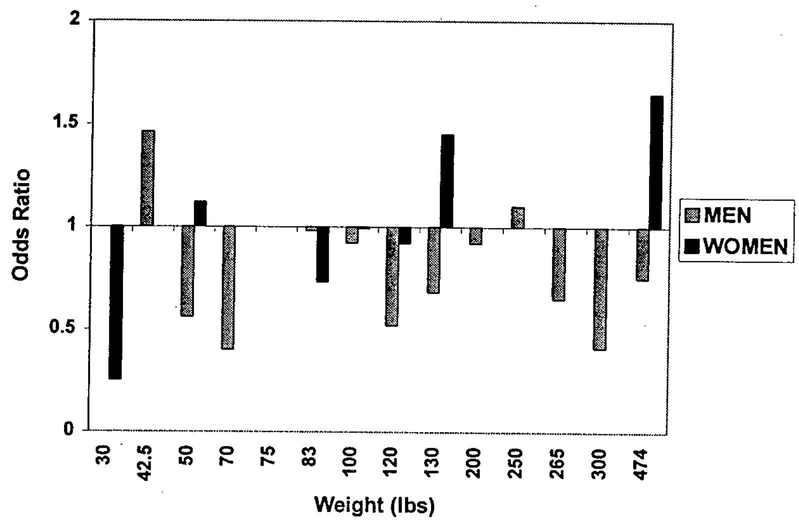


Figure 33. Relative Odds of Knee-Related Disability Discharge with Pushing/Pulling Groups Compared to No Pushing/Pulling for Men in the U.S. Army, Stratified by Race, 1980–1994

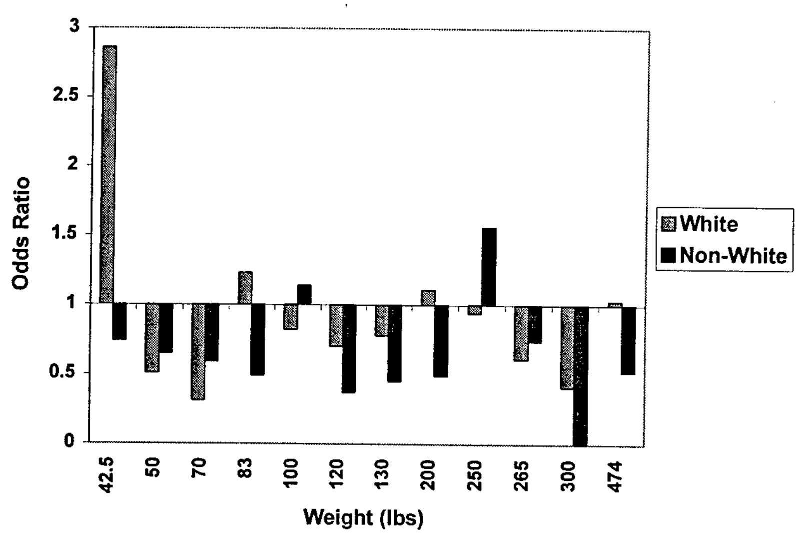
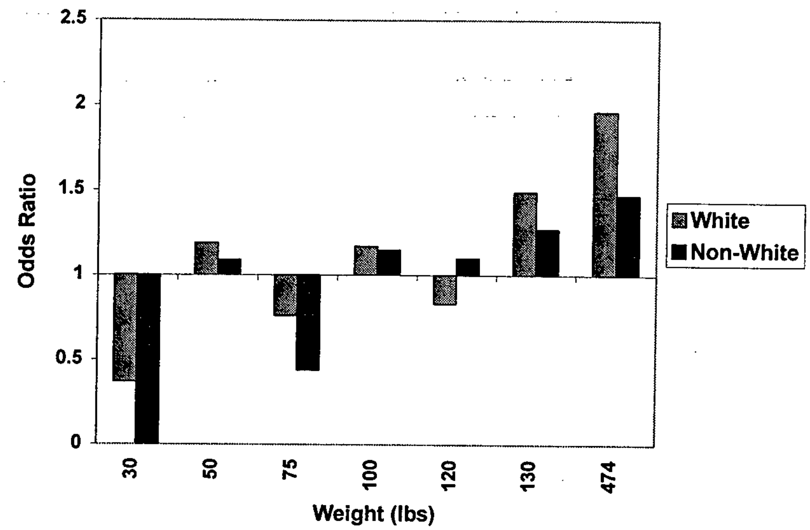


Figure 34. Relative Odds of Knee-Related Disability Discharge with Pushing/Pulling Groups Compared to No Pushing/Pulling for Women in the U.S. Army, Stratified by Race, 1980–1994



LOGISTIC REGRESSION

The final multivariable logistic regression models for both men and women had the same variables. These were race group, age group, pushing/pulling, maximum amount lifted, kneeling, sitting, and standing.

In the male model (Table 14), non-white men had a reduced risk of knee-related disability discharge compared to white men with an adjusted odds ratio of 0.82 (95% CI = 0.68–1.00). The age group trend followed an inverse "U" shape, with 23–26 year olds as the referent group. The maximum lifting categories approximated a "U'"shape curve, with an adjusted odds ratio of 1.66 (95% CI = 0.47–5.86) in the 1–25 pounds category, an adjusted odds ratio of 0.94 (95% CI = 0.46–1.92) in the 75–100 pounds category, and an adjusted odds ratio of 1.84 (95% CI = 0.91–3.72) in the 151–175 pounds category. All types of kneeling led to greater odds of knee-related disability discharge compared to no kneeling. Kneeling for prolonged periods had an adjusted odds ratio of 1.53 (95% CI = 0.87–2.67), kneeling while shoveling or lifting had an adjusted odds ratio of 1.22 (95% CI = 0.88–1.69), and kneeling while filing had an adjusted odds ratio of 2.54 (95% CI = 0.71–9.10). Men who had jobs with sitting in a physical task description had reduced odds of knee-related disability discharge with an adjusted odds ratio of 0.46 (95% CI = 0.13–1.56). Those who had standing in a physical task description also had reduced odds of knee-related disability discharge, with an adjusted odds ratio of 0.71 (95% CI = 0.46–1.08). All pushing/pulling categories had adjusted odds ratios less than the null value.

Table 14. Logistic Regression Model for Men with the Fifty Most Common PMOSs

Variable	Group	N	OR*	95% CI†
Race	White	1764	1.00‡	
	Non-white	1004	0.82	(0.68–1.00)
Age	17–20 years old	519	0.59	(0.45–0.77)
	21–22 years old	535	0.65	(0.50–0.85)
	23–26 years old	731	1.00‡	
	27–30.35 years old	371	0.99	(0.75–1.31)
	30.36–54 years old	532	0.86	(0.66–1.12)
Maximum Lifting	None	107	1.00‡	
	1–25 pounds	121	1.66	(0.47–5.86)
	26–50 pounds	153	1.13	(0.45–2.86)
	51–75 pounds	249	1.36	(0.68–2.71)
	76–100 pounds	500	0.94	(0.46–1.92)
	101–125 pounds	725	1.26	(0.66–2.41)
	126–150 pounds	98	1.38	(0.61–3.13)
	151–175 pounds	761	1.84	(0.91–3.72)
	Raises 267 pounds	54	1.42	(0.55–3.68)
Pushing/Pulling	None	2052	1.00‡	
	<130 pounds	262	0.86	(0.53–1.40)
	≥130 pounds	387	0.75	(0.53–1.05)
	feet per pound of force	38	0.60	(0.22–1.65)
	A wrench	29	0.99	(0.36–2.75)
Kneeling	None	1575	1.00‡	
	Prolonged periods	274	1.53	(0.87–2.67)
	While shoveling or lifting	900	1.22	(0.88–1.69)
	While filing	19	2.54	(0.71–9.10)
Sitting	None	2607	1.00‡	
	Sitting	161	0.46	(0.13–1.56)
Standing	None	2186	1.00‡	
	Standing	582	0.71	(0.46–1.08)

* Odds ratio
† 95% Confidence interval
‡ Referent group

The multivariable logistic regression model for women included the same variables, but had different trends and adjusted odds ratios (Table 15). Non-white women had a reduced risk of knee-related disability discharge compared to white women, with an adjusted odds ratio of 0.40 (95% CI = 0.33–0.49). This is a much lower adjusted odds ratio than the one found in the male model (OR = 0.82). There were differences in the other variables as well. Among women, the odds of having a knee-related disability discharge increased with increasing age, approximating a linear trend with 23–26 year olds as the referent group. Among men, there was an inverse 'U' shape with increasing age. For maximum weight lifted, the adjusted odds ratios for women also had a 'U' shape curve as the weight increased, but the curve was shifted to the right compared to men. The adjusted odds ratio for the 1–25 pounds category was 2.31 (95% CI = 1.23–4.34), which dropped to 0.94 (95% CI = 0.51–1.72) in the 26–50

pounds category, and then increased as weight increased. Pushing/pulling greater than 130 pounds increased the odds of having a knee-related disability discharge, whereas pushing/pulling less than 130 pounds of pushing/pulling in feet per pound of force did not increase the odds of injury. Having sitting as a physical task description decreased the odds of injury, with an adjusted odds ratio of 0.51 (95% CI = 0.28–0.94). Standing in a physical task description also reduced the risk of a knee-related disability discharge, with an adjusted odds ratio of 0.83 (95% CI = 0.61–1.14).

Table 15. Logistic Regression Model for Women with the Fifty Most Common PMOSs

Variable	Group	N	OR*	95% CI†
Race	White	1307	1.00‡	
	Non-white	1323	0.40	(0.33–0.49)
Age	17–20 years old	483	0.88	(0.66–1.18)
	21–22 years old	489	0.93	(0.69–1.24)
	23–26 years old	698	1.00‡	
	27–30.35 years old	413	1.13	(0.83–1.53)
	30.36–54 years old	415	1.61	(1.20–2.15)
Maximum Lifting	None	154	1.00‡	
	1–25 pounds	700	2.31	(1.23–4.34)
	26–50 pounds	331	0.94	(0.51–1.72)
	51–75 pounds	416	1.04	(0.61–1.77)
	76–100 pounds	708	1.36	(0.80–2.31)
	101–125 pounds	182	1.58	(0.87–2.85)
	126–150 pounds	0		
	151–175 pounds	105	1.48	(0.45–4.90)
	Raises 267 pounds	36	1.75	(0.46–6.65)
Pushing/Pulling	None	2006	1.00‡	
	<130 pounds	387	0.91	(0.54–1.53)
	≥130 pounds	166	1.18	(0.43–3.27)
	feet per pound of force	73	0.88	(0.46–1.69)
	A wrench	0		
Kneeling	None	1405	1.00‡	
	Prolonged periods	920	0.75	(0.50–1.11)
	While shoveling or lifting	251	1.17	(0.66–2.07)
	While filing	56	1.27	(0.58–2.76)
Sitting	None	1919	1.00‡	
	Any sitting	713	0.51	(0.28–0.94)
Standing	None	1415	1.00‡	
	Any standing	1217	0.83	(0.61–1.14)

* Odds ratio
† 95% Confidence interval
‡ Referent group

Both of these models had a good fit using the Hosmer-Lemeshow Goodness of Fit Test[28]. This test calculated a p-value of 0.9130 for the male model and a p-value of 0.9690 for the female model for the null hypothesis that the models fit the data.

DISCUSSION

INTERPRETATION OF RESULTS

The objective of this report is to create a system for coding occupations within the Army by physical tasks to assess any association with discharge for knee-related disability discharge. Through a case-control study design, researchers conclude that the hypothesis that occupational physical tasks are associated with knee-related disability discharge is supported. While physical tasks are not measured directly, there is strong theoretical and historical rationale for acceptance of these categories as a proxy for the actual physical demands of a given Army occupational specialty. Grouping military occupational specialties (MOSs) by physical tasks is an appropriate way to assess the relationship of occupation and disabling knee injuries. The physical task groupings that were found to have meaningful trends and associations were maximum weight lifted, pushing/pulling, kneeling, sitting, and standing. The MOSs that were grouped together to form these categories can be found in the Appendix of this report.

Several studies have reported gender differences which found that female athletes injure their knees more frequently than male athletes.[5, 9–11] One hypothesis is that differences in injury rates may be due to differences in physiology between the genders.[10, 12–15] Since all analyses in this report were stratified by gender and different MOSs were included in each analysis, differences between men and women should be noted carefully. To properly analyze the differences between genders within the same occupations, a subset of MOSs that includes both men and women should be analyzed.

Racial differences were found in both genders. Both men and women who were non-white had reduced odds of discharge for knee-related disability discharge compared to white individuals. In particular, non-white women were less than one half as likely to have a knee-related disability discharge (OR = 0.40) compared to white women, whereas non-white men were 80% as likely to have a knee-related disability discharge (OR = 0.82) compared to white men. There are three possible explanations for this phenomenon. First, there may be physiological differences between the races. Second, this finding may be a reflection of racial bias in the system that establishes disabilities in the U.S. Army. In other words, non-whites may be less likely to be labeled as disabled compared to whites with a similar knee injury. Finally, self-selection of individuals into various occupational groups varies by race, and certain occupational subgroups are at a greater risk of injury.

Previous military studies found associations between knee injuries and running.[16, 18, 19] This study found associations between knee-related disability discharge and various levels of running or walking, but there was no distinct trend in risk as the amount of running increased. When the maximum amount of running or walking was put into the multiple logistic regression models, colinearity problems resulted in dropping

different levels of either running/walking or weight lifted. Even after controlling for all other variables, the odds ratios for distance run/walked still did not have a distinct trend. Although this finding differs from the findings of previous studies, it is important to note that the other studies did not control for as many occupational physical tasks as this report. Most importantly, amount of weight lifted was not included in any of these previous military studies.

This report found associations between risk of knee-related disability discharge and maximum amount of weight lifted. The univariate analysis resulted in a linear trend of increasing odds with increasing weight. After controlling for the other physical factors in the multiple logistic regression models, the trend followed an inverse "U" shape. Among men, the lowest odds of knee-related disability discharge occurred among those required to lift 76–100 pounds, whereas higher odds were found for those required to lift other amounts of weight. Among women, the lowest odds of disability occurred at 51–75 pounds, one weight category lower than the category for the men.

This "U" shape curve may be an indicator for the physical fitness of groups of individuals at the time the weight was lifted. The differences in the genders may be correlated with the physiological differences that have been noted in the literature.[10, 12–15] Soldiers who lift weight in the lower categories may be in worse shape or not as strong as the soldiers who lift weights in the middle categories. For example, administrative specialists have "sitting" in their physical tasks descriptions, which is an indicator of a sedentary job. They also lift 1–25 pounds, which is associated with an increased risk of injury. Because they are more sedentary, when administrative specialists do lift weight, they face increased odds of injury. Finally, as the amount of weight lifted increases past a threshold for each gender, the risk of knee-related disability discharge may increase due to physical demands on the knee, regardless of muscle strength or physical fitness.

Another physical task analyzed in this study was pushing/pulling. Among men, all types of pushing/pulling resulted in reduced odds of knee-related disability discharge compared to no pushing/pulling. Among women, odds of a knee-related disability discharge increased past the threshold of 130 pounds. Once again, the differences in genders could be due to physiological differences between men and women. Although it is unexpected that pushing/pulling different weights would lead to a reduced risk of knee injury, it may be an indicator of physical fitness, with those who have job descriptions of pushing/pulling being in better shape than those who have jobs without pushing/pulling.

Other studies have reported an association between kneeling and knee injuries.[3,4] This report also found that kneeling is associated with increased odds of knee-related disability discharge after controlling for other physical tasks. Among men, individuals who had occupational tasks requiring that they kneel for prolonged periods were 1.5 times more likely to be discharged for knee-related disability discharge compared to soldiers who were not required to kneel for prolonged periods. In contrast, women had lower odds of being discharged for knee-related disability if their occupation

required prolonged periods of kneeling. The male and female models for this analysis included all of the same MOSs. The odds may be different in the two models if men were asked to do more kneeling than women. Further study is required to explore this possibility.

Men and women whose MOS descriptions included kneeling while shoveling or lifting were about 20% more likely to be discharged for knee-related disability discharge compared to those who had no kneeling in their MOS description. There were also increased odds of discharge for those soldiers whose MOS descriptions included kneeling while filing as compared to those whose MOS descriptions included no kneeling. These results demonstrate that kneeling is a risk factor for knee-related disability discharge.

Having sitting and standing in the MOS description was associated with lower odds of discharge for knee-related disability discharge. The reduction in odds of discharge was greater among those in the sitting vs. no sitting than it was in the standing vs. no standing category. If the job description includes sitting for any amount of time, the job tends to be more sedentary. Therefore, if less strain is being put on the knee, there is less chance that a knee-related disability discharge will occur. This is also true for standing compared to no standing, except the odds of discharge are not reduced as greatly as in the sitting category. This may be because there is some strain on the knee while standing.

LIMITATIONS

Strong associations between the physical tasks in the primary MOS and risk of discharge for knee-related disability discharge were found in this study, but there are some limitations to this report that are worth noting. First, the primary MOS was used rather than the duty MOS. Although preliminary analysis found PMOS and DMOS in a given year to be strongly correlated, the correlation was not perfect.

Furthermore, we are limited in our knowledge of what physical tasks individuals actually perform. The primary MOS was used to define physical tasks associated with a soldier's job, and these MOSs were used for grouping individuals. Although certain tasks are defined in the MOS description, it does not mean that soldiers actually perform any or all of these tasks. Finally, none of these tasks may have been performed if the soldier performed a different job than that indicated by the PMOS.

Another limitation of this study is that only physical tasks, gender, age, and race were included in the analyses. Disabling knee injuries may be related to other factors besides the physical tasks of the individual's occupation and demographic variables. For example, having an undiagnosed knee injury prior to service may make a soldier more likely to sustain a knee-related disability discharge on the job. Although the TAIHOD has some information on preexisting conditions, it is missing for many of the soldiers in the pilot study. A second factor could be pay grade or rank of the soldiers.

Soldiers with lower rank may be more or less likely to perform the tasks in their PMOS or DMOS that would put strain on their knee, and may perform other tasks outside their PMOS or DMOS. A third risk factor could be non-work related physical activities. Although an injury must occur on the job for the soldier to be eligible for disability in the U.S. Army, the injury may have first occurred in the context of recreational activities, or recreational activities may have exacerbated an injury that occurred on the job. Either way, it may be a combination of occupational physical tasks and recreational activities that results in a knee-related disability discharge. Finally, this study did not account for treatment that occurred after injury. The type of treatment received may be directly related to whether a knee injury became a disabling one or whether the soldier could continue to perform his or her job.

There could also be limitations to using the broad definition of knee-related disability discharge as the dependent variable. The 11 disabling knee injuries included in this study may not all have the same risk factors. Different physical tasks may predict the odds of one type of knee-related disability discharge over another type.

Finally, because the study population consisted of U.S. Army enlisted personnel, the results may not be generalizable to other groups. Although the Army is similar to the civilian sector in that it employs individuals in many different populations, the individuals enlisted in the Army are unique in at least one aspect. In order to enroll in the U.S. Army, individuals must fall within a narrow age range and pass a physical fitness test. Therefore, the population of individuals found in the U.S. Army may be more physically fit than a comparably aged group in the general U.S. population.

SIGNIFICANCE

Although there are limitations to this report, it has important public health significance. Disabling injuries result in a loss of a job and may affect the daily lifestyle of the injured individual. Moreover, the mental health of the injured person may be compromised if the injury leads to depression over the loss of a job and diminished physical capacity. These factors in turn may affect the entire family unit.

Also, the U.S. Army employs a large population. Therefore, even if the results of this study are not generalizable to the general population, these findings still affect a large number of people within the Army. In particular, this study found that there were differences in the risk factors by gender. Future studies need to look at men and women in the same job to assess the effects of gender on knee-related disability discharge.

When studies such as this one identify risk factors that increase the odds of injury, the results can be used to focus prevention programs and interventions. For example, increased odds of a knee-related disability discharge were found to be associated with most types of kneeling and some levels of lifting weight. These

observations could be used to reduce the amount of this activity or to design devices to help reduce the stress on the knee.

Finally, there are financial implications in the study of disabling injuries. The U.S. Army estimated the economic impact of physical disability in 1994 was approximately 500 million dollars for disability payments alone.[3] Therefore, if factors increasing the odds of injury are elucidated and prevention is implemented, the costs of these injuries to the U.S. Army could be reduced.

FUTURE RECOMMENDATIONS

This study population was stratified by gender and used race, age, and physical tasks of the MOS as independent variables. Future studies should consider other independent variables such as pay grade, injuries prior to service, body mass index, height, weight, and recreational activities as well. Future studies should also consider more specific dependent variables, such as specific disabling knee injuries. Finally, a study should examine the effects of occupational tasks on other types of knee injuries (e.g., ones that cause only partial or temporary disability). Through these studies, the effects of occupational physical tasks on the knee may be better determined.

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APPENDIX: PMOSs IN THE PHYSICAL TASK CATEGORIES

Table A-1. PMOSs in the Maximum Lifting Categories for Men and Women in the U.S. Army, 1980–1994

Maximum Lifting Category	Men PMOS	Women PMOS
None	00R: Recruiter/Retention NCO 75Z: Personnel Sergeant 91B: Medical Specialist	75Z: Personnel Sergeant 88N: Transportation Management Coordinator 91B: Medical Specialist
1–25 lbs	71L: Administrative Specialist 75B: Personnel Administrative Specialist 96B: Intelligence Analyst	71D: Legal Specialist 71L: Administrative Specialist 73C: Finance Specialist 75B: Personnel Administrative Specialist 75C: Personnel Management Specialist 75D: Personnel Records Specialist 75E: Personnel Actions Specialist 91S: Preventive Medicine Specialist 96B: Intelligence Analyst
26–50 lbs	16S: Man Portable Air Defense System Crewmember 91C: Practical Nurse 94B: Food Service Specialist	71G: Patient Administration Specialist 91C: Practical Nurse 91D: Operating Room Specialist 91E: Dental Specialist 91R: Veterinary Food Inspection Specialist 93P: Aviation Operations Specialist 94B: Food Service Specialist
51–75 lbs	13F: Fire Support Specialist 16P: CHAPARRAL Crewmember 31U: Signal Support Systems Specialist 52C: Utilities Equipment Repairer 55B: Ammunition Specialist 74C: Record Telecommunications Operator-Maintainer 91A: Medical Equipment Repairer	31U: Signal Support Systems Specialist 55B: Ammunition Specialist 71M: Chaplain Assistant 74C: Record Telecommunications Operator-Maintainer 91A: Medical Equipment Repairer 91K: Medical Laboratory Specialist 91P: Radiology Specialist 98C: Signals Intelligence Analyst

Maximum Lifting Category	Men PMOS	Women PMOS
76–100 lbs	13E: Cannon Fire Direction Specialist 19D: Cavalry Scout 31C: Radio Operator-Maintainer 31R: Multi-channel Transmission Systems Operator-Maintainer 92A: Military Police 92A: Automated Logistical Specialist 95B: Military Police 98G: Voice Interceptor	31C: Radio Operator-Maintainer 31L: Cable Systems Installer-Maintainer 31R: Multi-channel Transmission Systems Operator-Maintainer 74B: Information Systems Operator-Maintainer 92A: Automated Logistical Specialist 92Y: Unit Supply Specialist 95B: Military Police 98G: Voice Interceptor
101–125 lbs	12B: Combat Engineer 12C: Bridge Crewmember 13B: Cannon Crewmember 19E: M48-M60 Armor Crewman (Reserve Component) 52D: Power Generation Equipment Repairer 63B: Light-Wheel Vehicle Mechanic 63H: Track Vehicle Repairer 63S: Heavy-Wheel Vehicle Mechanic 63T: BRADLEY Fighting Vehicle Systems Mechanic 63W: Wheel Vehicle Mechanic 67N: UH-1 Helicopter Repairer 77F: Petroleum Supply Specialist	52D: Power Generation Equipment Repairer 63B: Light-Wheel Vehicle Mechanic 63H: Track Vehicle Repairer 77F: Petroleum Supply Specialist
126–150 lbs	19K: M1 Armor Crewman 62E: Heavy Construction Equipment Repairer	
151–175 lbs	11B: Infantryman 11C: Indirect Fire Infantryman 11H: Heavy Anti-armor Weapons Infantryman 11M: Fighting Vehicle Infantryman 88M: Motor Transport Operator	88M: Motor Transport Operator
Raises 267 lbs	54B: Chemical Operations Specialist	54B: Chemical Operations Specialist

Table A-2. PMOSs in the Pushing/Pulling Categories for Men and Women in the U.S. Army, 1980–1994

Pushing/Pulling Categories	Men PMOS	Women PMOS
None	00R: Recruiter/Retention NCO	31L: Cable Systems Installer-Maintainer
	11B: Infantryman	31R: Multi-channel Transmission Systems Operator-Maintainer
	11C: Indirect Fire Infantryman	31U: Signal Support Systems Specialist
	11H: Heavy Anti-armor Weapons Infantryman	52D: Power Generation Equipment Repairer
	11M: Fighting Vehicle Infantryman	63B: Light-Wheel Vehicle Mechanic
	13B: Cannon Crewmember	63H: Track Vehicle Repairer
	13F: Fire Support Specialist	71G: Patient Administration Specialist
	19D: Cavalry Scout	71L: Administrative Specialist
	19K: M1 Armor Crewman	73C: Finance Specialist
	31R: Multi-channel Transmission Systems Operator-Maintainer	74B: Information Systems Operator-Analyst
	31U: Signal Support Systems Specialist	74C: Record Telecommunications Operator-Maintainer
	52C: Utilities Equipment Repairer	75B: Personnel Administrative Specialist
	52D: Power Generation Equipment Repairer	75C: Personnel Management Specialist
	63B: Light-Wheel Vehicle Mechanic	75D: Personnel Records Specialist
	63H: Track Vehicle Repairer	75E: Personnel Actions Specialist
	63T: BRADLEY Fighting Vehicle Systems Mechanic	75Z: Personnel Sergeant
	63W: Wheel Vehicle Mechanic	88N: Transportation Management Coordinator
	71L: Administrative Specialist	91A: Medical Equipment Repairer
	74C: Record Telecommunications Operator-Maintainer	91B: Medical Specialist
	75B: Personnel Administrative Specialist	91E: Dental Specialist
	75Z: Personnel Sergeant	91P: Radiology Specialist
	91A: Medical Equipment Repairer	91R: Veterinary Food Inspection Specialist
	91B: Medical Specialist	91S: Preventive Medicine Specialist
	92A: Automated Logistical Specialist	92A: Automated Logistical Specialist
	95B: Military Police	95B: Military Police
	96B: Intelligence Analyst	96B: Intelligence Analyst
	98G: Voice Interceptor	98C: Signals Intelligence Analyst
		98G: Voice Interceptor
<130 lbs	12C: Bridge Crewmember	55B: Ammunition Specialist
	13E: Cannon Fire Direction Specialist	71M: Chaplain Assistant
	16P: CHAPARRAL Crewmember	77F: Petroleum Supply Specialist
	16S: Man Portable Air Defense System Crewmember	91C: Practical Nurse
	55B: Ammunition Specialist	91K: Medical Laboratory Specialist
	77F: Petroleum Supply Specialist	92Y: Unit Supply Specialist
	91C: Practical Nurse	93P: Aviation Operations Specialist
	94B: Food Service Specialist	94B: Food Service Specialist

Pushing/Pulling Categories	Men PMOS	Women PMOS
≥130 lbs	12B: Combat Engineer 19E: M48-M60 Armor Crewmember (Reserve Component) 54B: Chemical Operations Specialist 63S: Heavy-Wheel Vehicle Mechanic 67N: UH-1 Helicopter Repairer 88M: Motor Transport Operator	54B: Chemical Operations Specialist 88M: Motor Transport Operator 91D: Operating Room Specialist
ft/lb force	31C: Radio Operator-Maintainer	31C: Radio Operator-Maintainer 71D: Legal Specialist
Pushing/pulling a wrench	62E: Heavy Construction Equipment Repairer	

Table A-3. PMOSs in the Kneeling Categories for Men and Women in the U.S. Army, 1980–1994

Kneeling Categories	Men PMOS	Women PMOS
None	00R: Recruiter/Retention NCO	31C: Radio Operator-Maintainer
	12B: Combat Engineer	31L: Cable Systems Installer-Maintainer
	12C: Bridge Crewmember	31R: Multi-channel Transmission Systems Operator-Maintainer
	13B: Cannon Crewmember	31U: Signal Support Systems Specialist
	13E: Cannon Fire Direction Specialist	52D: Power Generation Equipment Repairer
	16P: CHAPARRAL Crewmember	54B: Chemical Operations Specialist
	16S: Man Portable Air Defense System	55B: Ammunition Specialist
	19E: M48-M60 Armor Crewman (Reserve Component)	63B: Light-Wheel Vehicle Mechanic
	19K: M1 Armor Crewman	63H: Track Vehicle Repairer
	31C: Radio Operator-Maintainer	71D: Legal Specialist
	31R: Multi-channel Transmission Systems Operator-Maintainer	71G: Patient Administrative Specialist
	31U: Signal Support Systems Specialist	71M: Chaplain Assistant
	52C: Utilities Equipment Repairer	73C: Finance Specialist
	52D: Power Generation Equipment Repairer	74B: Information Systems Operator-Maintainer
	54B: Chemical Operations Specialist	74C: Record Telecommunications Operator-Maintainer
	55B: Ammunition Specialist	75Z: Personnel Sergeant
	62E: Heavy Construction Equipment Repairer	88M: Motor Transport Operator
	63B: Light-Wheel Vehicle Mechanic	91A: Medical Equipment Repairer
	63H: Track Vehicle Repairer	91B: Medical Specialist
	63S: Heavy-Wheel Vehicle Mechanic	91C: Practical Nurse
	63T: BRADLEY Fighting Vehicle Systems Mechanic	91D: Operating Room Specialist
	63W: Wheel Vehicle Mechanic	91E: Dental Specialist
	67N: UH-1 Helicopter Repairer	91P: Radiology Specialist
	74C: Record Telecommunications Operator-Maintainer	91R: Veterinary Food Inspection Specialist
	75Z: Personnel Sergeant	91S: Preventive Medicine Specialist
	88M: Motor Transport Operator	92Y: Unit Supply Specialist
	91A: Medical Equipment Repairer	93P: Aviation Operations Specialist
	91B: Medical Specialist	95B: Military Police
	91C: Practical Nurse	98C: Signals Intelligence Analyst
	95B: Military Police	98G: Voice Interceptor
	98G: Voice Interceptor	
Prolonged periods	71L: Administrative Specialist	71L: Administrative Specialist
	75B: Personnel Administrative Specialist	75B: Personnel Administrative Specialist
	92A: Automated Logistical Specialist	75C: Personnel Management Specialist
		75D: Personnel Records Specialist
		75E: Personnel Actions Specialist
		92A: Automated Logistical Specialist

Kneeling Categories	Men PMOS	Women PMOS
While shoveling or lifting	11B: Infantryman 11C: Indirect Fire Infantryman 11H: Heavy Anti-armor Weapons Infantryman 11M: Fighting Vehicle Infantryman 13F: Fire Support Specialist 19D: Calvary Scout 77F: Petroleum Supply Specialist 94B: Food Service Specialist	77F: Petroleum Supply Specialist 91K: Medical Laboratory Specialist 94B: Food Service Specialist
While filing	96B: Intelligence Analyst	88N: Transportation Management Coordinator 96B: Intelligence Analyst

Table A-4. PMOSs in the Sitting Categories for Men and Women in the U.S. Army, 1980–1994

Sitting Categories	Men PMOS	Women PMOS
None	11B: Infantryman	31C: Radio Operator-Maintainer
	11C: Indirect Fire Infantryman	31L: Cable Systems Installer-Maintainer
	11H: Heavy Anti-armor Weapons Infantryman	31R: Multi-channel Transmission Systems Operator-Maintainer
	11M: Fighting Vehicle Infantryman	31U: Signal Support Systems Specialist
	12B: Combat Engineer	52D: Power Generation Equipment Repairer
	12C: Bridge Crewmember	
	13B: Cannon Crewmember	54B: Chemical Operations Specialist
	13E: Cannon Fire Direction Specialist	55B: Ammunition Specialist
	13F: Fire Support Specialist	63B: Light-Wheel Vehicle Mechanic
	16P: CHAPARRAL Crewmember	63H: Track Vehicle Repairer
	16S: Man Portable Air Defense System Crewmember	71D: Legal Specialist
		71G: Patient Administration Specialist
	19D: Calvary Scout	71M: Chaplain Assistant
	19E: M48-M60 Armor Crewmember (Reserve Component)	74B: Food Service Specialist
	19K: M1 Armor Crewman	74C: Record Telecommunications Operator-Maintainer
	31C: Radio Operator-Maintainer	77F: Petroleum Supply Specialist
	31R: Multi-channel Transmission Systems Operator-Maintainer	88M: Motor Transport Operator
		91A: Medical Equipment Repairer
	31U: Signal Support Systems Specialist	91B: Medical Specialist
	52C: Utilities Equipment Repairer	91C: Practical Nurse
	52D: Power Generation Equipment Repairer	91D: Operating Room Specialist
		91E: Dental Specialist
	54B: Chemical Operations Specialist	91K: Medical Laboratory Specialist
	55B: Ammunition Specialist	91P: Radiology Specialist
	62E: Heavy Construction Equipment Repairer	91R: Veterinary Food Inspection Specialist
	63B: Light-Wheel Vehicle Mechanic	91S: Preventive Medicine Specialist
	63H: Track Vehicle Repairer	92A: Automated Logistical Specialist
	63S: Heavy-Wheel Vehicle Mechanic	92Y: Unit Supply Specialist
	63T: BRADLEY Fighting Vehicle Systems Mechanic	94B: Food Service Specialist
		95B: Military Police
	63W: Wheel Vehicle Mechanic	98C: Signals Intelligence Analyst
	67N: UH-1 Helicopter Repairer	98G: Voice Interceptor
	74C: Record Telecommunications Operator-Maintainer	
	77F: Petroleum Supply Specialist	
	88M: Motor Transport Operator	
	91A: Medical Equipment Repairer	
	91B: Medical Specialist	
	91C: Practical Nurse	
	92A: Automated Logistical Specialist	
	94B: Food Service Specialist	
	95B: Military Police	
	98G: Voice Interceptor	

Sitting Categories	Men PMOS	Women PMOS
Sitting	00R: Recruiter/Retainer NCO 71L: Administrative Specialist 75B: Personnel Administrative Specialist 75Z: Personnel Sergeant 96B: Intelligence Analyst	71L: Administrative Specialist 73C: Finance Specialist 75B: Personnel Administrative Specialist 75C: Personnel Management Specialist 75D: Personnel Records Specialist 75E: Personnel Actions Specialist 75Z: Personnel Sergeant 88N: Transportation Management Coordinator 93P: Aviation Operations Specialist 96B: Intelligence Analyst

Table A-5. PMOSs in Standing Categories for Men and Women in the U.S. Army, 1980–1994

Standing Category	Men PMOS	Women PMOS
None	11B: Infantryman	31C: Radio Operator-Maintainer
	11C: Indirect Fire Infantryman	31L: Cable Systems Installer-Maintainer
	11H: Heavy Anti-armor Weapons Infantryman	31R: Multi-channel Transmission Systems Operator-Maintainer
	11M: Fighting Vehicle Infantryman	31U: Signal Support Systems Specialist
	12B: Combat Engineer	52D: Power Generation Equipment Repairer
	12C: Bridge Crewmember	54B: Chemical Operations Specialist
	13B: Cannon Crewmember	63B: Light-Wheel Vehicle Mechanic
	13E: Cannon Fire Direction Specialist	63H: Track Vehicle Repairer
	13F: Fire Support Specialist	71D: Legal Specialist
	16P: CHAPARRAL Crewmember	71G: Patient Administration Specialist
	16S: Man Portable Air Defense System Crewmember	73C: Finance Specialist
	19D: Cavalry Scout	74B: Food Service Specialist
	19E: M48-M60 Armor Crewmember (Reserve Component)	75Z: Personnel Sergeant
	19K: M1 Armor Crewman	77F: Petroleum Supply Specialist
	31C: Radio Operator-Maintainer	88M: Motor Transport Operator
	31R: Multi-channel Transmission Systems Operator-Maintainer	91A: Medical Equipment Repairer
	31U: Signal Support Systems Specialist	91B: Medical Specialist
	52C: Utilities Equipment Repairer	91C: Practical Nurse
	52D: Power Generation Equipment Repairer	91D: Operating Room Specialist
	54B: Chemical Operations Specialist	91E: Dental Specialist
	62E: Heavy Construction Equipment Repairer	91K: Medical Laboratory Specialist
	63B: Light-Wheel Vehicle Mechanic	91P: Radiology Specialist
	63H: Track Vehicle Mechanic	91R: Veterinary Food Inspection Specialist
	63S: Heavy-Wheel Vehicle Mechanic	91S: Preventive Medicine Specialist
	63T: BRADLEY Fighting Vehicle Systems Mechanic	92Y: Unit Supply Specialist
	63W: Wheel Vehicle Mechanic	93P: Aviation Operations Specialist
	67N: UH-1 Helicopter Repairer	98C: Signals Intelligence Analyst
	75Z: Personnel Sergeant	98G: Voice Interceptor
	77F: Petroleum Supply Specialist	
	88M: Motor Transport Operator	
	91A: Medical Equipment Repairer	
	91B: Medical Specialist	
	91C: Practical Nurse	
	98G: Voice Interceptor	

Standing Category	Men PMOS	Women PMOS
Standing	00R: Recruiter/Retention NCO 55B: Ammunition Specialist 71L: Administrative Specialist 74C: Record Telecommunications Operator-Maintainer 75B: Personnel Administrative Specialist 92A: Automated Logistical Specialist 94B: Food Service Specialist 95B: Military Police 96B: Intelligence Analyst	55B: Ammunition Specialist 71L: Administrative Specialist 71M: Chaplain Assistant 74C: Record Telecommunications Operator-Maintainer 75B: Personnel Administrative Specialist 75C: Personnel Management Specialist 75D: Personnel Records Specialist 75E: Personnel Actions Specialist 88N: Transportation Management Coordinator 92A: Automated Logistical Specialist 94B: Food Service Specialist 95B: Military Police 96B: Intelligence Analyst